DRYLAND FARMING IN INDIA

A SELECT ANNOTATED BIBLIOGRAPHY

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BY

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This is to certify that the M.Lib. Science dissertation of Mr. Shyam Singh on " Dryland Farming in India : A select annotated bibliography " was compiled under my supervision and guidance.

(Almuzaffar A.G. Khan)
READER

Dedicated to the Lasting
Memory of my
MOTHER

C O N T E N T S

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Shyam Singh

(SHYAM SINGH)

ALIGARH

10-9-1990

AIMS, SCOPE AND METHODOLOGY

Having chosen a topic to study the beginers is forced with problems of getting information that might enable him to answer that questions. The topic of my bibliography deals with the crop productions and methods used for improvement of the soil and utilization of the land of low moisture areas such as Rainfed , Dryland, Arid zone etc.

The varieties most suitable for such type of conditions, the methods used for cultivation such as Intercropping , cropping patterns , fertilization , mulching etc. are selected for bibliography.

The information on the topic 'Dryland farming in India' has been selected from various sources. These are reference sources and periodical literature such as ulrich International periodical Directory, Indian Guide to periodical literature, Index India, and different Journals library catalogues of Maulana Azad Library, Seminar libraries of Department of Geography and Commerce, Aligarh Muslim University, Aligarh and Jawahar Library, R.B.S. College Bichpuri, Agra are also consulted for searching primary and secondary sources which are related to the subject.

STANDARD FOLLOWED

As far as possible the International Standard, has been followed, After searching the literature, entires were recorded on 20 x 12 cm. Cards. The entries in the bibliography contains abstracts giving essential information about the articles. Each entry has been given a subject Headings. The subject headings are derived on the basis of indexable terms and with the help of sear's list of subject Headings.

ARRANGEMENT

The bibliography is in three parts, part one deals with the historical background of Dryland farming.

Part two deals with bibliography. Entries in bibliographical part have been arranged alphabetically according to their subject Headings. Almost letter by letter method is followed under specific subject Headings. The specific subject Headings are underlined. The entires are serially numbered to facilitate location of an item through index given in part -III. Each bibliographical entry contains the following items of information.

a) Serial number
b) Name of author / authors (a semicolon (;) in between the authors).
c) A full stop (.)
d) title of the article including sub-title and alternative title, if any.

e) A full stop(.)

f) title of the periodical in abbreviated or in full form.

g) A full stop (.)

h) Months of periodicity in abbreviated form, if available with article.

i) Year of periodical publication

j) A coma (,)

k) Volume number

l) Issue number in bracket

m) A coma (,)

n) inclusive pages of article.

A Specimen of the entry is given below :-

AGRO-TECHNIQUES

1. Dhiman,S.D. ; Sharma, H.C.; Singh, R.P. Role of agro-techniques in the production of rainfed wheat. Indian J. Agron. Sept-Nov. 1979, 24(3),345-7.

The present study discusses the agro-techniques FYM, microbial culture, FYM+Spirillum lepaferum, planofix, Cycocel, Kaolin, Planofix + Kaolin and Cycocel + Kaolin with a control. The level of nitrogen kept was 0,30 and 60 kg N /ha in the main piots. The yield of wheat may be increased with the use of FYM (@) 10 tons /ha plus microbial culture due to their favourable effect on no of ear /m row length and 1000 grain

weight. The highest WUE (154) was recorded with the use of spirillum lepoferum plus FYM and followed by FYM, Spirillum lepoferum and planofix It was it was recorded lowest (115) with the use of kaolin.

INDEXES

Third part deals with the combined Author, title and subject index for the convenience of users.

ABBREVIATIONS

A list of abbreviated and full form of the Journals have been provided and a general list of abbreviations used have also been provided in the part III Indix.

PART ONE

INTRODUCTION

I N T R O D U C T I O N

Agriculture is the largest and most important sector of Indian economy. About 70% of the people depend up on agriculture and a large part of it in India is still a gamble in annual rainfall. In Bombay, Madras, Panjab and the earstwhile states of Rajputana, Hyderabad and mysore, there are extensive areas which have mostly dependent on rainfall for crop production. Agricultural development in India so far had been made only towards the irrigated areas whereas the vast dry-land / rainfed areas which account for about 74 percent of net cultivated area still remained neglected. But the present Government has emphasized and taking suitable steps for growing the crops on dryland/ rainfed soils. These areas contribute about 42 percent to total food grain production and bulk of pulses, oilseeds, industrial crops like cotton and ground nut are cultivated under rainfed conditions.

Before beginning, we should be clear about the meaning and scope of dryland farming, About 74 percent of our agriculture is rainfed or dryland agriculture. There may be two implications of dryland farming.

1- Those areas which are located in moist but where agriculture is largely rainfed may be regarded as regions of dryland farming. For example chatanagpur, Madhya Pradesh , Orissa etc.

2- It may apply only to such regions where the environment is really dry with a limited amount of rainfall an absence of irrigation,and where such crops are grown which are adapted to dry conditions.

AREAS OF DRYLAND FARMING :

This include south-western part of U.P., Bihar , Panjab and Haryana, almost all the Rajasthan, Gujarat, Malwa, Rayalaseema and adjoining regions of Andhra Pradesh a belt in Maharashtra, Karnataka and western ghats.

CLIMATIC CONDITIONS:

The main components of climate which affect the crop production in drylands are rainfall, temperature, relative humidity, wind velocity, sunshine , etc. The climatic conditions of important five dry farming Research Stations of India, such as :

(i) Rohtak in the South-east Panjab,

(ii) Sholapur

(iii) Bijapur on the plateau of the Bombay-Deccan

(iv) Raichur, about 150 miles to south of sholapur;

(v) Hagari near Bellary on the plateau known as the Madras- Deccan which is more or less contiguous with the plateau of Bombay has been discussed.

Rohtak represents the northern dry zone in India, while the other four stations represent the Southern dry-zone of the peninsular India.

(i) TEMPERATURE :

Temperatures in the north show a very wide range, the absolute maximum record being 115°F in may and minimum sometimes reaching the freezing point, viz.32°F. In the South, although the maximum temperature recorded is nearly the same as in the north, the minimum never reaches the freezing point. The monthly means fluctuate between 70°F and 92.2°F. There is a district cold season experienced in the north and the het season extends longer than in the South.

(ii) RAINFALL and IT's DISTRIBUTION:

The rainfall in the north is very low and is obtained mostly by the South-West monsoon. But there is invariably some rainfall during the cold season . The rainfall is recieved in a limited number of days. It is extremely variable and is much below the normal in several years.

The normal rainfall in South varies from 45-70 cm. It is received on a larger number of days at their stations The variabilities are great both in the annual total as well as in the monthly quotas. Breaks and droughts are experienced during the monsoon currents which facilitate

the loss of soil moisture by evaporation. Deficiency of rainfall proves a limiting factor in crop production in some years.

(iii) WIND VELOCITY AND DIRECTION:

Wind is fairly high in the South while it is limited in the North. There is a planty of sunshine in the South during the crop growing season and also during the hot season. In the north the sunshine is distinctly lower during the cold season.

(iv) RELATIVE HUMIDITY :

The northern stations shows lower humidities in general and consequently higher evaporations during August-September. Only in cold weather, the evaporations are much lower and humidities higher due to cold wether rains. In the South, humidities are high only during the monsoon months from June to octobr but are lower during main crop growing season. The evaporation is also high during the crop growing period and during the hot season from march to the end of May.

SOILS AND THEIR CONDITIONS IN DRYLAND REGIONS

I- INDO-GANGATIC PLAIN·

The alluvial plains contain two main type of soil, viz Light loam and Heavy loam. The lands are almost

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Kantikar, V.V. Dryfarming in India, p.46-61.

level with an average fall of 2 feet per mile. The general elevation above the sea level may vary from 700 to 800 feet.

The mechanical analysis of soil samples from several profiles shows that in the light loams, sand and silt portions make up 70 to 80 percent of the soil, in the heavy loam, the clay content of the lower layers may reach almost 40 percent and the sand fraction decreases proportionately. The presence of lime nodules as Kankar, especially in lower layess is a typical feature of the heavy loam. The great pore space combined with low volume expansion ensures easy penetration of rain water to lower layers. Even small showers of rain thus become useful. The low hygroscopic coefficient and the low wilting point allow the utilization of most of the water held by the soil.

Chemical analysis indicates that the soils are rich in essential plant food ingredients like nitrogen, potash, phosphoric acid.

II- BOMBAY DECCAN -

The soils of problem area of the Bombay Deccan have been derived from the basalt or the Deccan trap. The tract is undulating and consists of series of low ridges and valleys. The configuration favours runoff of rain water and consequent soil erosion. It is computed

that nearly 40 percent of Arable lands have been so heavily recorded that they are no longer suitable for growing rabi crops that are grown on conserved moisture from rainfall. The elevation of this tract varies from 2,000 ft. in the west to 1,400 ft. on the eastern boundary.

The soils of Sholapur and Ahmedanagar districts of Bombay- Deccan are grouped in three classes based on thickness of soil layer and these are called deep, medium deep , and the light shallow soils. Bijapur district contains comparatively much deeper soils which indicate deposition of material brought down by the water action. Presence of lime nodules or kankar indicate continued leaching of lime from upper layers soil in to the lower layers. Erossion has removed the 'A' horizon completely, exposing the 'B' horizon on surface.

Mechanical analysis of soils indicate that the clay and the silt fractions together make up more than 80 percent of the whole soil. The clay content alone in one case is as high 71 percent.

Chemically all the soils are rich in nitrogen potash, and phosphoric acid. In the case of highly eraded land, the thickness of soil layer proves limiting.

III_ HYDERABAD STATE :

This tract is situated to the east of dry district of the Bombay-Deccan like Ahmednagar, Sholapur, and Bijapur. The Southern districts of Raichur has another geological formation with the granitic and gneissic rocks- of Archean age. In these areas two main types of soils are met with. One of these is the famous Red Soil of the Southern India and the other represents the black cotton soil, derived from the oldest gneissic rocks.

The Red soils are found to vary in their depth from 6 to 30 inches, immediately below this layer, disintegrated rock, viz. granite or gneiss is found some time with accumulated lime or Kankar is found. The red soils are usually met with near the outcrops of rocks or near hills and ridges while the deep black soils are found in low lying positions.

Red soils indicate a high proportion of sand fractions in the mechanical analysis. The Black Cotton Soils on the other hand, show high clay content approaching that some of the deep black soils of the Bombay Deccan. Where the clay content is moderate, the soils show good physical character.

IV. MADRAS DECCAN :

The soils of this tract having high pore space and high volume expansion impede the penetrability of rainwater to lower layers and their high shrinkage induces hardening and clad formation of the surface layer. These characters are unsuitable for good -plant growth, Chemical analysis of these soils reveals great deficiency of nitrogen and phosphoric acids.

V. ARID-ZONES OF RAJASTHAN :

In the arid zone of Rajasthan, Sandy plains interpressed with varying frequency of different types of dunes occur over 64.6 percent of the area (Dhir, 1977b). The dune soils are highly Sandy (3.6 + 6.2% clay, 1.8 to 3.1% silt, the rest being sand fraction), structureless with hardly any evidences of pedogenesis. Grey brown loams occupy 13.6 percent of the region, mostly in the south-east part. These soils have reasonably well developed structure and are thus stable against erosine force of the wind.

The data on the available form of the major and micro-nutrient element for some of the soils show that

the humus content is low to very low, the available phosphorus and potassium are, however, present in an adequate amount.

IMPORTANT DRYLAND CROPS AND THEIR VARIETIES IN RELATION TO DIFFERENT AREAS AND CLIMATIC CONDITIONS

WHEAT : SUJATA-A, C-306, Meghdoot, Mukta, IWP72, K65, Kalyan Sona, VL 616, Sonalika, This crop can be grown in the black Deccan soils. This is due to quick drying of upper soils inhibiting the development of a secondary root system and tillering. In the black cotton soils, the cultivator has a choice of crops like cotton, wheat and linseed.

RICE : Neela, Chaika 59, N22, Bala, Kanchan, Kiran, Cauvery, Ratna, Kalinga, Annanda,

We may include rice among the dryland crops but such unirrigated rice of small quantity and poor variety is monsoon rice grown in parts of Maharashtra, Andhra Pradesh, Gujrat and Madhya Pradesh.

Kantikar, N.V. Dryfarming in India, p.62-102.

BARLEY : Amber (K71), Patna, Vijay DL3, R 5.6 Himani.

The geographical requirements of barley include a low temperature, higher soil and lower soil moisture than what is needed for wheat. Barley is grown both irrigated and as a dry crop in eastern Rajasthan, U.P. , north-western Bihar and M.P.

PULSES : Gram (NP58)

Among the pulses gram is most important The maximum concentration is in Haryana, punjab northern Rajasthan and U.P. It is also grown in M.P., eastern Rajasthan , Maharashtra, northern Karnataka and north-western Andhra. Gram generally needs moderately heavy clay soils, including black cotton soils and the same land as wheat and barley.

BAJARA : HB-3, FS generation of hybrid

Bajara is a typical dryland food and fooder crop. It is a crop of Rajasthan , Gujrat, South eastern Haryana , South Western U.P., including the lower Ganga-yamuna doab, Bundelkhan, north-western madhya pradesh the drier regions of Maharashtra, Andhra Pradesh and

Tamil nadu, but the maximum concentration is in Rajasthan. It is grown on poor black cotton soil of drier uplands.

JOWAR : JS-20, CSV-3,CSV-2, CSV-4,CSV-6,M33, CSH1&2, Local MJ164,

Jowar is a food and fodder crop requiring moisture conditions than bajara. It is largely a crop of peninsular India covering a large hectarage in Maharashtra, Andhra Pradesh, Western Madhya Pradesh, northern Karnataka, Tamilnadu Gujrat and Western Madhyapradesh It is also grown in eastern Rajasthan, Haryana and South-Western U.P. Like bajara. It is grown in regions of black cotton soil. It requires a well distributed rainfall and is injured by lack of rain in the proper season, by excessive humidity and cloudiness and a very high temperature.

MAIZE : Vikram, Amber, Shakti, Chandan -3.

Maize is also largely a rainfed crop when grown during the summer monsoon, It covers large areas in Jammu, Panjab, Himachal pradesh , Rajasthan, Haryana, U.P., Bihar, North Andhra Pradesh part of M.P. and east central Gujrat. It requires a rich elevated, well drained lighter soils, It needs light showers with short, sunny intervals.

LINSEED : It is grown in U.P., eastern Rajasthan, Madhya Pradesh, Maharashtra, north eastern Karnataka north eastern Andhra Pradesh and Bihar. An unirrigated rabi crop requires more or less the same soil as wheat and gram, e.g. a well drained loamy soil, especially if it is rich in lime. It is injured by cloudiness when in flower.

RAPE & MUSTARD: Pusa rai 45,pradash, Rape or tori is grown mainly in Panjab and Haryana and the submountain hill tract of U.P. They are also cultivated in northern and north-eastern Rajasthan, M.P. Bihar, Orissa, W.Bengal and Brahmaputra valley.

SESAMUM : Pratap (C-50) , type-13.
It is generally grown as a rainfed Kharif crop and partly as a rabi crop needing moderate moisture. The best soil of the Ganga plain is an upland well drained alluvial loam. It can grow on poor soil. The maximum concentration occurs in Southern U.P. and Rajasthan.

GROUNDNUT :'Spanish Improved': 'TMV-1; 'TMV-9; 'GAV-G1', TMV 10, 2, & M 13.
It is a primary crop of the Deccan, South of the Narmada and the Godavari basins, recieving

less than 1,000 mm annual rainfall. Groundnut is also grown in the middle parts of the Ganga Ghaghara doab, Punjab and eastern Rajasthan, A fairly high concentration occurs also in Maharashtra and Karnataka , easts of Ghats in Andhra, Pradesh and Tamil Nadu. Generally it needs 'a Sandy loam, light and porous soil; with plenty of lime, free subsoil drainage.

CASTOR : 'No 55', 'M-10', 'LC185', 'GAUCH 1'

It is grown in west-central Andhra Pradesh, States of Karnataka, north-west Tamil Nadu, and northern Gujarat. It requires well-drained loams to very light or heavy soils Excessive moisture is injurious.

COTTON: 'H4','DP 197', 'Bhagya'

Theere are three cotton zones of India (i) Indo-Gangetic divide the western U.P., growing plain (ii) the Deccan lava and Gujarat plain (iii) West-central Andhra and western Tamil nadu. There are five main classes of cotton soils in India, (a) rich, black clay or loamy soils such as those of Kathiawar and Gujarat, Producing the finest cotton.

(b) deep heavy moisture- retensive soils of the deccan lavas

(c) packets of black soils on the Archeans particularly on the basic gneisses of western Tamilnadu.

(d) The alluvial sandy soil is the regur or black cotton soil.

SUGARCANE :

Unirrigated sugarcane occurs mainly in northern parts of the Gangetic plains between yamuna and the kosi where there is natural moisture in the soil.

There are certain other crops which can also be grown in rainfed/ dryland conditions. Which are as under :

Oat (Forage)-Kent III-10

Cowpea

Setaria

Moth-T3

Guar-2470/12

Kodo

Pearlmillet

Mung

Urd and Pea

FOREST CROPS - Ber, and Acacia

Due to limited choice of crops matching the moisture availability period, lack of short duration and high yielding crop varieties, lack of suitable plant types for intercropping, socio-economic constraints, low literacy and a poor economic base. Scientists are engaged in the development of suitable dryfarming technology at different Research stations. They have prescribed the following practices to be adopted for dry-farming.

IMPROVED AGRONOMIC PRACTICES FOR DRYLAND FARMING

PLOUGHING :

Scientists thought to increase the production potential of drylands. Praces followed are deep ploughing of soil. Contour bunding should be done in order to store moisture in the soil.

Study showed that breaking up of inner layer under the plugh sole by deep ploughing enhanced the water intake and hydraulic conductivity. Ultimately this process enhanced the root growth of crops and increased the yield.

Mohammad Shafi; Mehdi Raza. Dryland Agriculture in India. p.26-45.

FERTILIZATION :

Fertilizer is the kingpin for increasing productivity in agriculture. Addition of plant nutrients in the form of fertilizers constitutes an essential step in agricultural production.

Application of organic manures like Farm yard Manure, green manure and compost is quite necessary to keep the soil in good tilth and balance, but they are in short production and can not meet the full requirements of crops. Hence, there is a necessity of making up the defficiencies by the use of inorganic or chemical fertilizers. Because of easily soluble in water, the nutrients in them are easily available.

Nitrogenous Fertilizers :

Nitrogenous fertilizers may be classified in to four groups on the basis of the chemical forms in which the nitrogen is present in them , namely ammonical and nitrate fertilizers and amide fertilizers. Fertilizers produced in India are urea, calcium ammonium nitrate, ammonium sulphate, ammonium chloride and ammonium sulphate nitrate.

Phosphatic fertilizers :

Phosphatic fertilizers or phosphates contain the nutrient element phosphorus. It may be classified in to three groups according to the forms in which the phosphorus contents are present. For example single super phosphate Double and Triple superphosphate.

Potassic Fertilizers :

Potassic fertilizers are applied to the soil to supply plants with potassium, the supply plants with potassium, the supply plants with potassium, the third major plant Nutrient. For example potassium chloride, potassium sulphate, potassium schenite.

Application of fertilizers:

An uniform dose of 50 kg N, 30 kg P_2O_5 and 20 kg K_2O/ha was applied . Entire dose of phosphorus and potash was applied at the time of sowing along with ½ of Nitrogen ½ Nitrogen should be used as foliar application. This method is more significant as compare to other methods of nitrogen application.

Entry No.21

Indian J. of Agrl. Eco. 1986, 41(4)p.320.

SOWING

From available results of experiments on the time of sowing, no arbitrary date of sowing can be fixed. The most suitable condition of sowing the rabi crops in adequacy of soil moisture by the wetting of soil layer to sufficient depth.

The crop pearlmillet sown in last week of July resulted in higher grain yield than both earlier or later sowings. Results of experiment showed that pearlmillet gave the highest yield when shown with the onset of the monsoon that is first fortnight of July.

Entry No. 65

Method of sowing are several for example dibbling transplanting , by seed drill, by chonga systems are very much popular. At the time of sowing row-spacing and seed rate should be maintain according to plant type and soil conditions, so that the crop plants do not suffer for adequate moisture and fertilizer contents.

CROPPING PATTERNS

MIXED CROPPING :

Crop mixtures are widely grown, especially during the kharif season, pulses and some oilseeds are

grown with maize Jowar and bajara, During rabi season wheat and barley, wheat and chickpea, and wheat, barley and gram are sown as mixed crops. Soils having own P content upto 12.2 kg p/ha were required to be incorporated the 8.7 kg p/ha for such crop mixtures.

Entry No.173

INTER CROPPING :

With particular reference to dryland agriculture, an intercropping system needs to be designed in such a way that in case of unfavourable weather, at least one crop will survive to give economic yields. Most remunerative intercropping systems are Sorghum + pigeonpea, Sorghum + Soyabeen, Sorghum + Groundnut and some other mixtures have been found to be reunerative.

SEQUENCE CROPPING :

Traditionally these areas grow a single crop of long duration and the productivity becomes uncertain in subnormal years of rainfall. Then an idea evolved to change the pattern and grow short duration crops followed by some other short duration crops. Sorghum-safflower sequence cropping proved highly beneficial in terms of net returns and benefit cost ratio.

Entry no. 28,-30 No.

SOIL & MOISTURE CONSERVATION : MULCHING

The process in which we cover the soils either by artificial means or natural means to retain the soil moisturecontent and reduces evaporation.

Results of experiment showed that wheat with the application of mulch and Kaolin consumed water economically and saved about 35.0, 36.6, and 15.0 mm water against 218 mm used by untreated control.

Entry No. 57

Study indicated that the maximum advantage of mulch was noticed when it was applied immediately after emergence. In some years, mulch improved the growth as well as production which increased from 20 to 120 percent in different mulching treatments.

Entry No.59

Crop mulching was found to be useful for conserving the moisture. The use of pine-needle mulch caused the wheat yield to increase by 3.31 kg/kg seed.

Entry No. 60

Experiments also showed that straw mulch reduces the fluctuation in soil temperature and increase total biomass production in wheat. Grain and straw yield of wheat increased when straw mulch at 5 and 7-5 tonnes/ha was applied after sowing of wheat.

Entry No. 62 &63

IRRIGATION AND WEEDING :

Though, there is a lack of irrigation but if the cultivator has such facilities and crop is in tremendous need of water then irrigation should be done. Experiments showed that in case of cowpea the yield is very much influenced by weekly water availability. In case of sorghum application of 1 cm and 2 cm runoff water as supplemental irrigation gave 15 to 25% higher grain yield over no irrigation.

Entry No.49 & 50

Weeds are plants , which grow where they are not wanted. There are several methods of controlling them such as : Mechanical methods - Hand pulling, hoeing, tilling, burning, flooding etc. cultural and cropping methods and finally chemical methods.

Experiments showed that use of atrazine (2-chloro-4 ethylamino-6- isopropylamino-5-traizine), 2,4-D, and 2,4,5-T was most effective in eradication of weeds and hence enhance crop production in drylands.

Entry No. 248-50

PEST CONTROL :

Insects and pests are the living animals who attack on the crop plant and disturb the physiolosy of plants. So for removal of those spraying of BHC-10%, Aldrin 5% Dimethoate, endosulphan, carbaryl should be done

according to the prescribed quantity and methods to different crops. Seed treatment should be done before sowing with the use of fungecides.

Entry No. 195, 196, 197

HARVESTING:

It is difficult to fix the time of harvesting of crops. The crop should be harvested Just after the dough stage that is the stage before falling down the grains in the soil and at this stage seed becomes bold and dry.

CONTINGENCY/ALTERNATIVE CROP PLANNING

The major source of waterfor dryland crops is monsoon rains which are highly uncertain. The following alternate cropping strategies have been developed.

i) In case of delayed rains in late July

-Transplanting of bajara

- Sowing of bajara in place of pulses

ii) In case of delayed rains up to the first week of August

-Planting of traditional grain legumes, sugar and moth.

iii) Occurence of Drought early in the season

The gap could be filled transplanting 3 week old the bajara seedlings, the complete removal

of weeds, the use of organic mulches or vegetal wostes.

iv) Occurrence of Drought early in the season

- Plant population should be reduced
- Protective irrigation from harvested water.

CONCLUSION:

In order to supply of food for rapidly increasing population, scientists thought that the only way out of this problem was to concentrate on dryland farming as it seemed to be most effective method to substantially raise the output of food.

The myth of food self sufficiency, disappeared when India had to import about 2 million tonnes of wheat in 1981-82 to bolster up the fast declining buffer stock. The immediate solution to the existing problem r seemed to be switch over to dryland farming, production in dryland has increased by more than 300 percent where full technology package has been adopted.

PART TWO

BIBLIOGRAPHY

AGRO-TECHNIQUES, CROP-CEREAL, WHEAT-RAINFED

1. Dhiman, S.D.; Sharma, H.C.; Singh, R.P. Role of agro-techniques in the production of rainfed wheat, Indian J. Agron. Sept-Nov 1979, 24(3), 345-7.

The present study discusses the agrotechniques FYM, microbial culture, FYM/ Spirillum lepoferum, planofix, cycocel, Kaolin, Planofix + Kaolin and cycocel + Kaolin with a control. The level of nitrogen kept was 0, 30 and 60 kg N/ha in the main piots. The yield of wheat may be increased with the use of FYM @ 10 tons per hectare plus microbial culture due to their favourable effect on no of ear/m row length and 1000-grain weight. The highest WUE(154) was recorded with the use of spirillum lepoferum plus FYM and followed by FYM, spirillum leopferum and planofix. It was recorded lowest (115) with the use of Kaolin.

ARID-ENVIRONMENT-CROPS-OIL-SEEDS-SEASAME-GENETICS-PHENOTYPE/ GENOTYPE

2. Kumar, D. Phenotypic stability for quantitative traits of seasame under rainfed conditions of arid environment. J. Oil Seeds Res. 1988, 5(1), 8-12.

Study indicated the phenotypic stability of 5 quantitative traits for sesame by growing 10 genotypes in 8 environments under rainfed conditions. The strains 4-2 and T-13 were the most stable for the seed yield in better environments whereas TC 171 and C6 exhibited maximum stability for yield in poor environment. Genotype X environment interactions were present, and large portion of these was accounted for linear component.

-LANDS,AGROECONOMICS, AGROMETRY-COST/BENEFITS

3. Singh,D.V.; Mathur, B.K. Relationship between costs and returns in the rainfed Kharif Crops on arid lands. Ann. Arid Zone. 1983, 22(4), 301-5.

In arid regions agriculture is a gamble on rainfall. The decision of farmers to reduce the cost of cultivation during risky and uncertain period, thus may be justified. It is difficult to show the effect of cost on the returns under such circumstances. Coefficient of correlation between cost and return was found unsuitable. The cost is not reflecting in returns with sound proportion.

MANAGEMENT-TECHNOLOGY,GENERAL,COST/BENEFITS-DRY FARMING

4. Reddy, Y.V.R. Economics and adoption levels of improved dryland technology among the targeted and Non-targeted farmers in Andhra Pradesh. Agrl. Situ. In India. Nov. 1988, XLIII(8),695-701.

Improvement in dryland farming is a crucial factor in the development of farmers economy in the arid and semi arid regions. The technology developed by research institutes has been transferred to farmers' fields through operational Research Project, Krishi Vigyan Kendra, Lab to Land Project and Watershed development programme. A survey was conducted to understand the economics and adoption levels of dryland technology between targeted and non-targeted farmers of the same village. Benefit cast ratio of dryland crops indicated that loss was more or profit was less in case of targeted farmers compared to non-targeted farmers due to adoption of

improved practices during drought year.

ZONES-ARABLE-CROP PRODUCTION,SYSTEM,RESEARCH-INDIA

5. Daulay, H.S. Farming Systems research in Indian Arid Zone. Geographer.July 1986, 33(2), 6-12.

In order to avoid the problems faced in arid zone cultivation, central Arid zone Research Institute and other Centres are trying to achieve the progress. In Arable farming-crops like pearlmillet, clusterbean, mungbean and Sesame in mixture/ intercropping are growing. Intercropping of grain legumes with cenchrus ciliaris and Lasiurus Sindicus, respectively, is advantageous for stablising the productivity and reducing the wind erosion hazard. Agro-forestry in fragile eco-systems envisages a sustainable land management system which increases the overall yield of land. Silvipastoral studies with three trees, i.e Acacia tortilis, Colaphos popermum mapane and Hardwickia binata at two different spacings (5 x 5 m and 10 x 10 m) indicated that the grass yield (Conchrus ciliaris) was not affected due to tree plantation.

MANAGEMENT ,CROPPING SYSTEMS-RAJASTHAN

6. Singh, R.P. Cropping systems for drylands of the Indian arid Zone. Ann. Arid Zone. 1980, 19(4), 437-43.

In this paper the author has discussed the cropping systems for drylands of Western Rajasthan. The study indicated two themes : (1) productivity, moisture use,

monetary returns and labour utilization in different patterns of cropping. (2) water harvesting and runoff recycling for maximum production on drylands of Rajasthan.

COMPARATIVE STUDIES-CROPS

COTTON; STRAINS; SHORT DURATION; 'DP 197'/'BHAGYA'

7. Katarki, B.H. Short duration Cotton strains for rainfed conditions. Indian Fmg. June 1982,32(3),10-13.

To overcome production constraints of ancient cotton varieties, some studies were initiated at Dharwar in 1968-69. Emphasis was given (1) To develop a desirable plant type of early crop maturity coupled with higher harvest index, and (2) to identify the short season intra-hirsutum hybrid for rainfed conditions. A total of 48 cross combinations with 4 maternal bases has yielded strains like 'DP 197' and 'DP 225' from 'Bhagya X'p.78'. 'DP-452' from 'Bhagya'x 'I.S.C.67 E-3', 'DP-197' and 'DP-225' are compact plant types, maturing in about 140 days and gane seed cotton yield of 13 q per hectare. 'DP-452' is a mid late strain, gives about 14.5 q/ha seed cotton and 39 kg lint/q of seed cotton.

VARIETY (H4),WARDHA- RAINFED (ABNORMAL)

8. Ashtekar, C.G. Cultivation of 'H4' cotton under abnormal rainfed conditions. Indian Fmg. April 1985, 36(1), 3-6

Experiments were conducted on two fields, for the season (1982-83). Results showed that under similar conditions yields can be increased by 40 to 80 percent. For achieving good yields in spite of drought, the following 6 steps have

to be followed :(i) Proper preparation of land, use of F.Y.M. optimum doses of fertilizers in split applications at proper time by 'spot application' (ii) Regular and frequent inspection of field (iii) Careful observation on germination, pests and diserves (iv) More than 5 percent gaps call for immediate adoption of techniques to achieve good plant population (v) Plant protection by use of proper pesticides (vi) For effective control use of synthetic pyrethroids be done at lower pest incidence.

MUSTARD,VARIETY (Pusa rai 45)

9. Gangasaran; Gajendra Giri. Studies on comparative Performance of mustards varieties under dryland conditions. Indian J. Agron. Sept-Nov. 1984, 29(3), 398-401.

An experiment was conducted on Sandy loam soil.Treatments Composing ten cultivars and Sowings were done on 16 and 17 October in 1980-81 and 1981-82 , respectively using 4 kg seld/ha. The sowing was done in rows spaced 50 cm. apart with uniform application of 50 kg N and 40 kg P_2O_5/ha. Pusa rai 45 produced the highest grain yield (25.0 q/ha) during both the years. The next best variety was pusa Bold (22.69) followed by Varuna (21.6 q/ha). Hence, variety pusa rai 45 was vessatile in its adaptability and could be recommended for drylands.

RICE, EARLY, VARIETY (Neela), DROUGHT/DISEASE-RESISTANT-UPLANDS

10. Roy, J.K. 'Neela'. An early maturing rice variety for rainfed uplands. Indian Fmg. May 1989, 39(2),8-9.

A new variety of rice, 'CR 404-56-1', named 'Neela' has been developed at CRRI, Cuttack. It matures in 90 days, tolerant to drought, pests, and diseases like blast. Yield trials have shown its superior performance as an early type. Being early and gall midge resistant, it is suitable for the Raipur Zone of Madhya Pradesh where this appears in early crop of rice. In light-textured lateritic soil, it produced around 3.5 tonnes per hectare while varieties like 'MW-10' and 'Kalinga-III' produced less. With all normal agronomic practices, phosphorus and potash as single superphosphate and Murate of potash at 25 kg per hectare should be applied as basal dressing 25+20+12 Kg. N per hectare should be applied after first weeding, 3 weeks after the top dressing two weeks after the last application of N respectively.

WHEAT (Sujata A), AREA-BARANI

11. Upadhyay, Y.M.; Ijardar, J.S.; Thakur, R.S.; Bhawsar, R.C. SUJATA-A new wheat for rainfed conditions. Indian Fmg. Nov 1981, 31(8), 15-6.

In rainfed areas, we can increase the productivity of wheat through superior varieties and management practices. A new variety 'Sujata' of wheat proved superior

to other cultivars in central zone. Its quick seed germination and come up to the soil surface and establish well help in its success in the barani areas. The variety resembles 'C 306' in most morphological characters. The plant has prostrate early growth vigour. Flowering takes place between 75-85 days and the emergence is non-synchronous. The variety takes 135-40 days from seeding to seed ripening. Grains are medium bold, uniformally filled, plump and round. Like other variation it is also rust resistant. The average yield of 'Sujata' was 29.5 q/ha while yield of kaliyan Sona was 28.0 q/ha at the same amount of fertilizer application.

CONSERVATION- MOISTURE, CROP-PRODUCTION, CULTIVATION

CROPS, GENERAL, YIELD-EXPERIMENT

12. Singh, R.A.; Singh, O.P.; Sharma, H.C.; Mahatim Singh. Yield and moisture use pattern of rabi crops grown under rainfed conditions of eastern U.P. Ann. Arid Zone. 1977,16(1) 61-6.

An experiment conducted on the Research Farm of Banaras Hindu University during the rabi season of 1970 to 1974. Wheat, barley, gram, and linseed crops were grown under rain-fed conditions Gram and barley yielded more in comparision to wheat and linseed. Moisture consumption of gram was highest followed by barley (DL 3), gram (T1 and 3) and linseed (T 397) were promising varieties in relation to moisture use efficiency.

CROPS, PEARMILLET

13. Pandey, S.K.; Kaushik, S.K.; Gautam,R.C. Response of rainfed pearlmillet (Penisetum glaueum) to plant density and moisture conservation, Indian J. agric. Sci. July1988, 58(7),517-20.

A field experiment was conducted with hybrid 'BK 560-230' pearlmillet (penisetum glaucum) cultivated with 2 plant densities (100,000 and 200,000 plants /ha) and 5 mulch and transpiration suppressants (Straw mulch at 5 tonnes /ha, presowing seed treatment with 0.2% KNO_3, 0.2% borax spray,6% Kaolin spray and atrazine spray along with Untreat control). More plant density (200,000 plants/ha) significantly increased the grain and stover yield than lower plant density of 100,000 plants/ha. Straw mulch, Kaolin spray, pre-sowing, seed treatment greatly influenced the water use efficiency and yield in drylands.

PULSES-GENERALS

14. Bhatia, K.S.; Srivastava, K.K.; Lal, B. Moisture Conservation efficiency of some legumes and their effect on the yield of rai (Brassica juncea coss) under rainfed conditions. Ann. Arid Zone 1980,19(142),14-8.

This experiment was conducted to assess the relative efficiency of different legumes in conservation of moisture and their effect on the yield of rai under dryland conditions.

Residual effect of different legumes was different from one another. Follow, moong and urd cropping system was found to be effective in increasing the yield of rai because of sufficient soil moisture conservation. Application of fertilizers did not improve the soil moisture status.

SORGHUM-EXPERIMENT

15. Robinson, J.G. ; Balasubramanian, T.N. ; Ravinkumar, V. Effect of different moisture conservation system on yield of Sorghum (CSH 6) in rainfed vertisols. Madras agric.J. 1986,73(5),255-8.

An experiment was conducted to study the effect of different moisture conservation systems on the yield of Sorghum. The result indicated that compartmental bunding was found to register significantly higher sorghum grain yield/ ha over flat bed system and found to be economically viable.

CROP PRODUCTION

CROPS-MILLETS ,PEARL/KODO,FERTILIZER-NITROGEN,DOSAGES-DRYLAND

16. Kaushik, S.K. ; Gautam, R.C. Comparative Performance of different millets at varying levels of nitrogen under dryland conditions. Indian J. Agron. Dec- Feb 1985,30(4),509-11

Discuss the comparative performance of different millet crops at varying levels of nitrogen under dryland conditions. The treatments included pearlmillet (Pennisetum americanum (L.)), foretail millet (Setaria italica L.) and Kodo millet (Paspalum scrobiculatum L.) and four levels of nitrogen (0,20,40 and 80 kg/ ha) in split plot design with three replications. Pearlmillet

produced the highest grain yield. The increase in yield (Pearlmillet equivalent) brough about by pearlmillet over Kodo millet and foxtail millet, on an average , was the order of 300 and 800 % , respectively, Kodo millet in turn proved superior to foretail millet in respect of grain production or pearlmillet equivalent.

INTERCROPPING,CROPS-WILDTURNIP/TARAMIRA-HARYANA-DRYLAND

17. Singh, B.P. ; Singh, J.P. Intercropping of wild turnip in taramira and Chickpea in dry arid sols of Haryana. Indian J. agric Sci. Feb. 1986, 56 (2), 96-100.

A 3- year field experiment conducted on arid sols of Bawal (Haryana) , Intercropping of wild turnip (Brassica tournifortti Gauan) in Taramira (Eruca vesicaria Linn.) and chickpea (Cicer arietinum Linn.) grown in paired rows gave 11.1% more total productivity than taramira as main crop and 81.9 % more productivity than sole cropped -chickpea. The water use efficiency was more in 2:2 system of wild turnip and taramira in the year of normal rainfall and 1:1 system in dry year. Hence, it is suggested that wild turnip and taramira should be grown in 2:2 System to get better yield.

RAPE/CHICKPEA,YIELD-Comparative study - DRYLAND

18. Singh, B.P. ; Singh, J.P. Comparative productivity potential of rapeseed mustard against Chickpea in dryland. Trans.Indian Soc. Desert Technol. 1988, 17-22.

It studied the production potential of the Brassicae Crops in South-Western Haryana. Indian mustard (Brassica Juncea L.) gave the maximum (17.56 to 17.74 q/ha) seed yield followed by toria Sarson (Brassica tornifortii) with 16.56 q/ha. A mean crop equivalent basis Indian mustard gave 119.7 to 121.9 % more seed yield over Chickpea (Cicer arietinum L.). Greater returns of Rs.3193, Rs.2764, Rs.2397 and Rs.1664 per hectare were recorded with yellow Sarson, brown Sarson, tora Sarson and tasamira over chickpea crop, respectively.

SORGHUM/COWPEA,MANAGEMENT,ENVIRONMENT-DRYLAND

19. Dutta, T.R. ; Patil, B.D.; Hazra, C.R. Environmental analysis on dryland crops of Sorghum and Cowpea (Pure and mixed). Ann. Arid Zone. 1980,19(4), 433-5.

Study indicated the analysis of the crop environment of Jawar at Jhansi, a dry area in Bundelkhand, U.P. The constraints of Crop production can identified with the help of preliminary data presented in the paper. The preliminary data superimposed with average climatic data can predict their yields in a given agro-climatic region.

SORGHUM/PEARLMILLET,HARVESTING, YIELD-DRYLAND

20. Masood Ali ; Rawat, C.R.; Dhar, S.N. Productivity of Kharif Crops as influenced by planting time under dryland conditions. Indian J. Agron. Mar-May 1981, 26(1),71-6.

An experiment was conducted under dryland conditions of Bulandelkhan region to assess the profitability and productivity of Sorghum, pearlmillet, redgram, soyabeen and blackgram on different dates of planting for 3 consecutive years (1977-79). of the two cereals, pearlmillet out yielded Sorghum on all dates of planting and was found to be the most remunerative crop. Amongst legumes, Soyabeen was found profitable even with August 5-20 planting, Early planting led to highest production and return from Sorghum, pearlmillet and redgram and decreased when planting was delayed. Highest yield of Blackgram could be achieved if planted on July 20 whereas planting dates did not affect the yield of Soyabeen.

CULTIVARS, CROP-PRODUCTION

CROP-CEREAL, WHEAT, METHODS-FERTILIZATION-NITROGEN

21. Yadav, K.D.; Singh, S.P. Response of Wheat Cultivars to different methods of Nitrogen application under rainfed conditions. Indian J. Agron. Dec-Feb. 1982, 27(4), 437-8.

A field experiment was conducted in rabi 1973-74 to compare the different methods of nitrogen application and also to study the performances of wheat cultivar (Kalyan Sona and MP 851) under rain fed conditions. An uniform dose of 50 kg N, 30 kg P_2O_5 and 20 kg K_2O/ ha was applied. Entire dose of phosphorus and potash was applied at sowing along with nitrogen fertilizer as per schedule prescribed ½ placement + ½ foliar application of N produced significantly more yield as compared to other methods of nitrogen application.

FRUITS-BER, VARIETIES Nazuk / Illaichi,

22. Yamdagni, R. ; Gupta, A.K. ; Ahlawat, V.P. Performance of different cultivars of ber (Ziziphus mauritiana L.) under rainfed conditions-A note. Ann.Arid Zone. 1985,24(2),175-7.

Experiment was conducted at the Dryland Research Station, Banlal (Haryana) to investigate the suitability of 31 cultivars to rainfed conditions. In comparision to others, per Cv. Koithli performed better. Other varieties e.g. Nazuk, Illichi and villaiti can also be grown under rainfed conditions. These varieties can also be used for hydridization of ber in rainfed conditions.

CULTIVATION-CROPS

- PEARLMILLET,HYBRIDS/VARIETIES-Performance of FERTILIZATION-NITROGEN.

23. Kaushik,S.K. ; Gautam,R.C. Response of pearlmillet hybrids to nitrogen fertilization and plant under rainfed conditions Indian J. agric. Sci. Jan. 1986, 56 (1), 37-40.

The field experiment held in 2-year with 3 varieties of peart millet (Pennisetum typhoides) hybrids ('CM 46','BD 111', and 'BJ 104'), grown at 3 levels of N (40,80 and 120 Kg/ha) and three plant densities (100,000, 150,000, 200,000 plants/ha) BD 111' gave the highest grain yield that is 22.8 q/ha. In rainfed areas the hybrids did not give good response beyond the 80 kg. N/ha, optimum use of N should be 52 kg/ha.

- SUGAR,SUGARCANE -RAINFED

24. Thakur, A.C. Effects of varieties, dates of planting and harvesting on cane and sugar yields in rainfed sugarcane. J.Res. Assam agric. Univ. 1985, 6(1),17-21 (Publ 1988).

Field experiments were conducted during 1977-78 to 1980-81 for scheduling planting and harvesting of some sugarcane varieties under Assam condition. Sugar yield indicated that the variety 'C0740' proved to be adoptable to the widest range of planting and harvesting dates followed by the varieties 'CO 997' and 'CO 1132' .The varieties 'CO 1132' and 'CO 7205' could be kept in the field for longer period without deterioration in quality.

CULTIVATION,CROPPING-PATTERN

- CROPPING PATTERN -DRYLAND

25. Singh, R.P.; Atar Singh; Ramakrishna, Y.S. Cropping Patterns for drylands of India-An agroclimatic approach. Ann. Arid Zone 1974,13(2), 145-64.

At almost all stations, improved varieties of traditional crops having higher yield potential and better moisture utilization efficiency have been identified for the arid region. New and beneficial crops like Sunflower, castor and cowpea have been indicated . At Bellary, rabi Jowar and safflower have shown the better results. Yields can be increased upto 300 per cent in case of rabi Jowar by adopting

the early sowing in September on the red soils of Anantpur, Hyderabad and Hebbal, Cotton and Safflow could be grown successfully on the blacksoils. In the dry subhumid region, with moisture index range of -33 to 0, two good crops could be taken with advantage, with suitable adoption of agro-techniques.

HARVESTING, YIELD -effect of-SAFFLOWER-RAINFED

26. Ahuja, K.N.; Singh, R.R.; Singh, K.P. Study of Inter and inter-row spacings affecting growth, yield and quality of Safflower under rainfed conditions. Indian J. Agron. June Aug 1981, 26(2), 200-202.

The experiment comprising row spacing viz. 30,45 and 60 cm noted by R_1, R_2 and R_3 respectively and 3 plant spacings of 10,15, and 20 cm noted as S_1,S_2, S_3, respectively with three replications in a randomized block design. The total N and P was applied as basal dressing at the rate of 60 kg/ha and 40 kg /ha through urea and single superphosphate, respectively The highest yield was recorded in the treatment of 45 cm row to row and 10 cm plant to plant spacings. The quality of grain as judged by protein percentage was influenced by spacing treatments.

INTENSITY-DRYLAND

27. Reddy, Y.V.R. Economics of increasing cropping intensity in dryland agriculture in India. Andhra agric. J. 1986, 33(4), 303-13.

Increasing cropping intensity in drylands is possible through inter and sequence cropping system. The cost of cultivation in case of intercropping system were more, the gross net returns were also higher. The intercropping system generated more human labour employment. Sequence cropping (two crops) over single crop during the agricultural year was more profitable.

- SEQUENCE,EVALUATION,JALGAON -DRYLAND

28. Nikam, S.M. ; Tendulkar, A.V. ; Deokar, A.B. Evaluation of Sorghum (Sorghum bicolor) and Safflower (Carthamus tinctorius) sequence cropping on dryland. Indian J.agric.Sci. July 1988, 58 (7), 525-8.

This experiment indicated that a 2-year sequence cropping of 'Bhima' Safflower (Carthamus tinctorius Linn) and 'CSH6' Sorghum under rainfed conditions in Jalgaon (Maharashtra), grain and fodder yield of Sorghum and seed yield of Safflower did not show any significant variation with the change in planting pattern and time of harvesting of Sorghum. However, Sorghum-safflower sequence proved highly beneficial in terms of net returns and benefit: cost ratio. The sequence cropping of Sorghum-safflower was more profitable (Rs. 10,004/ha gross and Rs. 6.332 /ha) than the sorghum-Sorghum ratoon system, it gives Rs. 7,205/ha gross and Rs. 3,479/ha net.

Study of -North-West, Hills-RAINFED

29. Ved Prakash ; Tandon, J.P. Production Potentials and net returns from Echinochloa based crop sequences under rainfed conditions of North-Western hills . Ann. agric. Res, 1987, 8(2), 188-93.

In this study fine different cropping sequences of two crops per year based on Echinochloa were compared against the traditional three crops in two years rotation to assess the production potential and net returns. The average annual productions evaluated in terms of Echinochloa equivalent yield were 95.0, 96.9, 58.1, 54.6 and 48.4 q/ha and the annual net returns were Rs.4,078 , 4,077, 1.441, 827 and 618/ha under Echinathloa field pea, Echinochloa chickpea, Echinochloa Lentil, Echinochloa-wheat, and Ehinochloa-mustard sequences, respectively.

YIELD-effect on MUSTARD

30. Gajendera Giri ; Ganga Saran. Production efficiency of mustard based cropping sequences as influenced by the preceding season cultural practices in dry lands. Indian J. agric. Sci. Mar 1986, 56(3), 177-82.

This 3-year field experiment showed that fodder crop of cowpea or greengram harvested at the cessation of rains enabled mustard to be sown in the winter. Mustard crop gives 57 - 66 q/ha biomass when sown after cowpea as against 22 q/ha when grown after pearlmillet. The cropping sequence of Cowpea

mustard produced 11.86 million K cal energy, that is double from the other sequences and the net return was Rs. 6,904/ha.

CULTIVATION-CROPPING SEQUENCE

AGRONOMIC-PRACTICES,CROP-CEREAL-RICE-RAINFED

31. Dikshit, N.N.; Gupta, R.R. Rainfed areas can yield more paddy. Indian Fmg. April 1974, 24(1), 15-16.

On adoption of agronomic practices the yield of paddy can be increased from one tonne to three or four tonnes per hectare in rainfed areas of Uttar Pradesh. Some dwarf varieties can produce even higher yields than local varieties. The new varieties gave grain yield 4.5 tonnes per hectare by adopting new technique such as weed control measures and moderate doses of fertilizers, Viz. 60:30:30 N,P,K are applied, Moisture should be conserved by deep ploughing and preparing strong bunds all around the field. 60 to 70 kg seed per hectare should be sown behind deshiplough in shallow furrows, 20 cm apart and finally covered by planking. Weeding should be either by mechanical means if possible or by using weedicides such as stam F.34 and propanil etc. 30 kg N/ha should be used by top dressing immediately after weeding. The old variety like N22 can yield about 3 tonnes rice per hectare and the improved and new varieties gave grain yield of about 4 tonnes per hectare or even more.

CROP-CEREAL-WHEAT-RAINFED

32. Gupta, Birendra Kumar; Md. Taiyab. Cultural practices for rainfed wheat. Indian Fmg. Nov 1984, 34(8), 15-6.

Experiments indicated that the average yield of wheat can be increased considerably if the farmers grow rainfed varieties and follow cultural practices. The required temperature of sowing descends around 10th November to facilitate rainfed sowing. The rainfed wheat is responsive to 50 kg N, 25 kg P_2O_5 and 25 kg K_2O, if placed 10-15 cm below the surface soil. Some of these varieties like 'C 306', 'Sujata', 'Meghdoot', 'Mukta' 'IWP 72' and 'K65' are recommended for rainfed conditions. Apart from this other agronomic practices such as interculturing and plant protection measures should also be followed.

MULTIPLE,PROFIT/LOSS,EXPERIMENT-RAINFED

33. Boruah, A.R.;Hazarika, B.D.; Paul, A.M. Multiple cropping under rainfed condtions. Indian J. Agron. Mar-May 1984,29(1), 46-50.

The experiment was conducted during 1977-79 on Sandy loam soil at Assam Agricultural University, Jorhat. Study was with 13 cropping sequences of 200 and 300% cropping intensity. A three crop sequence of wheat moong (s)-rice(s) gave the highest net return of Rs.5,847/ha followed closely by mustard mung(s) rice (s) with Rs. 5,022/ha. This cropping sequence not only gave the highest return but is able to meet the requirements of an average farmers family for the view point of food and labour employment.

OILSEEDS/CEREAL, WHEAT(C-306) -RAINFED

34. Venkateswarlu, J.; Singh, S.N. Contingency plans for rainfed rabi crop. Indian Fmg. Oct 1979, 29(7),17-20.

The behaviour of the South-West monsoon during 1979 was aberrant in many ways. The actual dates of withdrawl of S.W. monsoon are last week of September and first of October. Kharif crops were seriously affected in U.P. and M.P. by the highly deficient rainfall conditions coupled with its uneven distribution and high day temperature. The position in respect to vidarbha, Marathawada and Deccan rabi beltis some what comfort- able since temperature does not play a critical role in the performance of rabi crops in this region. Improved agronomic practices such as : sowing of seed with next first soaking rains with optimum seed rate. Use 30 Kg N and 20 kg P_2O_5/ha for cereals and for oil seeds 30 kg N may be used. For delayed wheat sowing prefer C 306 variety. Wherever a critical irrigation is possible give one irrigation Aldrin 30EC should be used to control the termite in wheat crop.

SOWING-TECHNIQUES,CROP-CEREAL,RICE-UTTAR PRADESH,EASTERN-RAINFED

35. Singh, H.P.; Jaiswal, L.M.; Malik, N. Production technology for rainfed lowland rice in eastern Uttar Pradesh. Indian Fmg. June 1989,39 (3), 9-11.

A research was conducted at the Narendra Deva University of Agriculture and Technology, Faizabad, to push up the average

yields of rice in eastern Uttar Pradesh by adopting 6-point technology. Growth in the rainfed low land is affected by amount and duration of rainfall, depth and duration of standing water, flooding frequency, time of flooding and topography Deep water areas contain 50 to 100 cm. of water depth. Under such conditions the promising rice varieties are 'chaika 59', Madhukar and Jalmagn. The fertilizer must be applied below the surface in one application at seeding time. Urea supergranules (USG) have shown spectacular results. Flooding increases the availability of phosphorus in rainfed low land. Potassium should be applied as basal at transplanting stage. In low land rice, a double transplanting technique-transplanting with tillers detached from the mother plant of earlier transplanted crop is advantageous. Effective plant protection measures should be adopted and weeding should be done manually if possible or by using herbicides.

TILLAGE-PRODUCTIVITY/MOISTURE-effect on

36. Khan, S.A.; Chatterjee, B.N. Effects of tillage and date of harvesting of the preceding rice crop on productivity and moisture utilization of rainfed winter crops. Indian J. agric. Sci. Jan 1986, 56 (1),28-36.

The greater storage of moisture was found in those plots from which rice crop was harvested on 8 October. The 15 days delay in harvesting caused 21 mm soil moisture defficiency at a soil layer of 0.90 cm. more residual Soil moisture increased the emergence of seedlings of winter crops, which was more in untilled than tilled soil. Among winter crops the maximum

yield of barley was 1,565 kg/ha and minimum 838 kg/ha of linseed. Winter crops yielded 10% more when sown early and 22% more when conventional tillage operations adopted. Pea and sunflower appeared to utilize more soil moisture stored at depth of 75-90 cm. Winter crops used 6% more soil moisture under conventional tillage practices and 5-13% when sown early.

CULTIVATION-CROPPING SYSTEM

CROP-ROTATION,CROP-CEREAL,WHEAT/LEGUME-ECONOMIC-RAINFED

37. Kamta Prasad; Tandon, J.P.; Ved Prakash. Effect of rainy season Crops and nitrogen rates on the yield of rainfed wheat and the economics of its rotation with other crops. Indian J. agric. Sci. Mar. 1985, 55 (3), 172-6.

Study showed that grain legumes favourably affected the wheat yield and cropping system economics while fodder legumes were beneficial only to wheat yield. The mean yields of wheat were 20.64, 18.06, 17.84, 16.61 and 15.07 q/ha when grown after fodder cowpea, fodder horsegram, soyabean, adzukibeen, Soyabean + fingermillet intercrop and fingermillet respectively and were equivalent to direct application of 31.0, 28.4,20.1, 19.1, 14.0 and 7.5 kg N/ha respectively. The yield of wheat increased significantly with N application, the mean yields being 13.02, 18.60 and 22.5 q/ha at 0,20 and 40 kg N/ha.

-SEQUENCE,FERTILIZATION,effect of-COMMON MILLETS-RAINFED

38. Reddy, K. Ramakumar ; Reddy, T. Yellamanda, Rajan, M.S. Soundara; Reddy, P. Maheswara; Reddi, G.H. Sankera. Effect of fertility levels

on sequence crop of common millet under rainfed conditions. Indian J. Agron. Mar- May 1982,27(1),92-4.

Study the effect of different levels of N,P,K on sequence crop of 'Varada' common millet after a first crop of groundnut. The preceding crop of TMV 2 groundnut was fertilized with 20, 33 and 18 kg N,P and K/ha respectively. Data showed that plant height, number of productively increased with increasing level of N, p and K.

VARIETIES-IMPROVED -DRYLAND

39. Singh, R.A; Mahatim Singh. It pays to select a suitable variety for dylands. Indian Fmg. June 1976, 26(3),27.

Almost 3/4 of the total cultivated area in east U.P. is dependent on rainfall for crop growth. The results of the experiments showed that with Selection of Suitable crops and their varieties and adoption of moisture conservation practices, at least two crops, one in Kharif and another in rabi can be harvested successfully. In order to grow a successful rabi crop after a Kharif crop, maximus moisture will have to be conserved durking kharif season. Kharif crop should not be of more than 100 to 110 days duration. Barley among the cereals, gram followed by lentil among the pulses and linseed followed by musturd and safflower among the oil seed crops are recommended for drylands of eastern U.P. out of many varieties, 'K 112' , 'K 572/28', 'DL3', 'DL4' of barley, 'BG2', 'T1','T3',

'L9-12', and 'Pusa 6' of lentil, 'T397' and 'Mukta' of Linseed, 'T59' and 'Local (HU)' of mustard, 'N62- 8' and 'Hungud 2' of safflower are recommended.

CROP-GENERAL,MADHYA PRADESH-RAINFED

40. Gite, L.P.; Bhandarkar, D.M.; Singh, M.P. Double Cropping in rainfed black soils of Madhya Pradesh. Indian J. agric Sci. Oct 1987, 57 (10), 715-9.

A 2- year field experience showed that the successful cultivation of 'CSH6' Sorghum, 'J52' Soyabean and 'Chandan 3' Maize followed by rabi cropping could be done in black soils of Madhya Pradesh in the rainy season. The crop rotation of 'CSH6' Sorghum - 'H355' Chickpea gave net return of Rs.5,018, 'JS2 ' Soyabean - 'N 112' wheat of Rs. 4,586, 'Chandan 3' Maize 'H 355' Chickpea of Rs.3,649 and 'CSH6' Sorghum + 'T21' pigeonpea inter-cropping of Rs. 2,436/ha in the flat system of crop production.

CROPPING PATTERN,DOUBLE CROPPING,FERTILIZATION,effect of-MAIZE/WHEAT -RAINFED

41. Bhandari, A.L.; Sharma, K.N., Rana, D.N. Effect of fertilizers application on double cropping under rainfed conditions. Int.J. trop. agric. 1986, 4(3), 233-7.

Study conducted to see the effects of N, P and K on grain yiedls of maize and wheat and on available N, P and K in soil, in a maize- wheat cropping sequence. The application of N90 P30 K20 in the local and Ageti-76 varieties of maize increased the grain yield by 9.6 and 10.0 q/ha over control, respectively In wheat sown after maize fertilized with N 90 P30 K20,grain yield increased by 6.4 q/ha over control (No Po Ko), when no

fertilizer was used to wheat and by 15.7 q/ha when an application of N80 P30 Ko was done in wheat also.

SELECTION-CROPS,AGRONOMIC PRACTICES -UTTAR PRADESH,-CENTRAL-RAINFED

42. Suraj Bhan; Khan, S.A. Double Cropping under rainfed conditions of Central Uttar Pradesh. Indian J.Agron. Dec-Feb 1981,26(4), 371-6.

A field study with 20 crop rotations was conducted at the soil conservation Farm of the Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, to find out the feasibility of double cropping under rainfed conditions of central uttar pradesh. The study revealed that with the selection of suitable crops and varieties and adoption of proper agronomic practices, it is possible and profitable to follow double cropping in rainfed areas of central Uttar Pradesh where, normally one crop is grown in each season. The crop rotations such as, Fodder (Sorghum 8B)-Safflower 'T 65', fodder (Sorghum 8B) @ mustard 'KB2', Blackgram T9- mustard 'KB2', blackgram T9- Safflower 'T65', greengram 'K851'- mustard 'KB 2' and green gram 'K-851'-Safflower 'T65' appeared to be productive and remunerative than the practice of leaving land fallow in Kharif and taking a crop of mustard or safflower in rabi season.

SOWING-PULSES/OILSEEDS,VARIETY (Gram,Taramira)-RAINFED

43. Srivastava, Anil K.; Verma, B.; Pratap Narain. Studies on double cropping under rainfed conditions. Indian J.Agron. Mar-May 1985, 30(1), 64-71.

This study was conducted from 1978-79 to 1981-82 to find out the significant combination on double cropping under rainfed conditions. Green gram, black gram and cowpea each followed by Safflower. Mustard, taramira and gram in double cropping sequences were studied. Sorghum + pigeonpea intercropping (1:1) was included for comparision. The better combination was green gram -safflower sequence followed by green gram- taramira. Rainfall productivity of green gram safflower sequence (12.0 kg grain /Cm rains) was higher than other double cropping sequence and comparable to sorghum + pigeonpea (19 kg grain/cm rains). Green gram sequences were significantly better in energy value of grain yield than other double cropping sequences.

-SEQUENCE,DOUBLE,SAFFLOWER/BLACKGRAM -RAINFED

44. Nikam, S.M.; Patil, N.Y.; Deokar, A.B. performance of Safflower-based double-cropping sequences under rainfed condition. Indian J. agric. sic. Mar 1985, 55(3), 160-6.

This study indicated that safflower gave more yield when grown after blackgram (Vigna mungo Linn.) and greengram (Vigna radiata Linn.) than after sorghum, irrespective of fertilizer applied to preceding crop. Inspite of low yields of safflower after sorghum, Sorghum- Safflower cropping sequence gave higher monetary return of Rs.8,083 per ha than the sequences involving greengram and blackgram. Green gram and blackgram followed by safflower was the most suitable cropping sequence in this region.

-SYSTEM,DOUBLE CROPPING-ROTATION-DRYLAND

45. Singh,R.P.; Thakur,R.; Jagdish Seth; Sharma, S.K. Double cropping under Dryland (Rainfed) conditions: possibilities and prospects. IndianJ.Agron. Dec-Feb 1980, 25(4), 691-702.

Studied the role of mung (vigna radiata)'PS-16' and urd (vigna mungo) 'T-9' for grain and cowpea fodder 'EC -4216 with a follow plot on succeeding crop of mustard (Brassica Juncea (L)) 'varuna ' grown under 0,20 and 40 kg N/ha in rabi in double cropping was undertaken on a sady loan soil of low fertility on dryland conditions. 'Double cropping 'provided a potential possibility of increasing the total production from 50-150% by way of about 60% more increased production /ha/day helped due to its 200% cropping intensity. Growing of Kharif legumes showed the residual effect of 40-60 Kg N/ha, that is enough to support fully the need of succeeding crop of mustard. The met profit obtained from the double cropping was 2-3 times.

UTTAR PRADESH,CENTRAL - DRYLAND

46. Suraj Bhan. Feasibility of Dobble cropping under dryland conditions of central uttar pradesh. Indian J. Agri. Res. Oct-Dec 1978,12(4), 241-45 .

This study indicated the comparative performance of some double crop rotations under rainfed conditions with and without harvesting, reveled feasibility of double cropping in central travel of uttar pradesh, Moong 'T51'- Mustard 'KB2' rotations was found remunerative than single crop rotation

of follow mustard 'KB2'. The next best rotation was black-gram 'T9'- mustard 'KB2', The sowing of crop on raised cum sunken beds did not prove advantageous because water harvested in these bed percolated quickly due to light textured soil, thus the water needs of rice raised in sunken beds could not be satisfied which ultimately resulted in failure of the rice crop.

YIELD GAPS, UTTAR PRADESH-DRYFARMING

47. Gyanendra Mani; Pandey, V.K. Cropping pattern and yields gaps under dryland forming conditions in U.P. Agrl. Situ. in India, Mar 1990, XLIV (12), 1007-1010.

This study examined the cropping pattern and yield gaps under the dryland conditions of Agra district of Uttar Pradesh The crops of bajara, Laha and gram were found to be the major dry land crops in the district. During the cause of field investigation, the farmers indicated that they switch over to crop of maize and Arhar under good rainfall conditions, which causes some reduction in the area under bajara depending upon the resultant soil moisture availability. In case of Laha crop rainfall during september - october found to have significant impact upon its area sown. Analysis indicated that whereas cost of production of these three crops was higher on progressive by forms about 40 percent in gram to 90 percent in Laha and bajara as compared to non-progressive group.

CULTIVATION INNOVATIONS

INNOVATIONS - AGROTECHNIQUES

48. Venkateswarlu, J. Innovations in improvement of crop production in drylands (Res. rev.). Indian J. agric. Sci. June 1990, 60(6), 373-81.

Drylands in India constitute 70% of arable lands. Still the future additional production of food grains has to come from these lands only. Researches tried to introduce the high yielding varieties coupled with the use of fertilizers and other management practices. Some improvement is needed on : choice of crops and cropping patterns, vesstality of seeding equipments, soil moisture and residue management, nutrient supply rates and methods, and plant protection measures. The crops selected for dryland areas should be deep and strong rooted Run off rain water harvesting and management would bring stability in production. Crop rotation should be followed.

CULTIVATION IRRIGATION

AGROMETRY,IRRIGATION WATER,CROP-COWPEA-RAINFED

49. Ramana rao, B.V.; Ramakrishna, Y.S.; Daulay, H.S. Influence of water availability on yield of cowpea under rainfed conditions. Ann. Arid Zone. 1984, 23(1),63-6.

This has anlysed and reported the differences in the yield of Cowpea crop as influenced by weekly Water availability conditions. The correlation Co-efficient between the crop yield and mean AE/PE during the productive stage was found to be 0.98. The results of second degree regression equation was also fit for the reproductive stage.

IRRIGATION,PLOUGHING-FURROWS-DRYLAND

50. Masood Ali; Rawat, C.R.; Dhar, S.N. Single supplemental irrigation to Sorghum under dryland conditions of Bundelkhand. Indian J. Agron. Dec-Feb. 1980,25 (4), 673-6.

Study revealed that bed configuration accomplished by conversion of inter-row spaces in to shallow furrows after one month of sowing increased grain yield by 15 percent in low rainfall year (1977). The highest yield was obtained by alternate inter-row space converted in to shallow furrows. The application of 1 Cm and 2 cm runoff water a supplemental irrigation gane 15 to 25% higher grain yield over no irrigation but this irrigation should be done at flowering early milk stage.

CULTIVATION PLOUGHING

-DEEP,CROP-JOWAR,VARIETIES (M33)

51. Mittal, S.P.; Balvir Verma; Ramanath,B. Increase rabi Jowar yield in Small holdings under dryland conditions. Indian Fmg. Mar 1972,21 (12) 25-6.

Cultivation under rainfed conditions is uncertain and a gamble then it a major concern of agricultural scientists to increase the production potential of these lands. Practices fcllowed are deep ploughing of soils Contour bunding should be done in order to store moisture in the soil. FYM at 5 tonnes /ha is broadcast on the surface and placing fertilizer

DEEP/SHALLOW,HYDRAULIC WATER CONDUCTIVITY-ANANTAPUR-RAINFED

52. Reddy, D.Subbarami; Reddy,D. Ramachandra;Acharya,G.V.N. Studies on water intake and hydraulic conductivity in shallow and deep ploughing operations under rainfed agriculture at Anantapur. Ann.Arid Zone.1978,17(3),291-7.

This field experiment was conducted during Kharif season of 1972-73 and 1973-74 on red Sandy loam soils at Anantapur. Two type of ploughing operations namely shallow (10 cm depth) and deep (30 cm depth) with 6 replications were done in a strip plot design.Caster (Aruna), red gram (T-21), ground nut (TMV-3) and bajara (HB-3)were grown. Study showed that breaking up of inner layer under the plough sale by deep ploughing enhanced the water intake and hydraulic conductivity Ultimately, this process enhanced the root growth of cropsand increased the yield of castor, bajara and red gram.

WHEAT,YIELD effect on, HILLS DOON-VALLEY

53. Rai, R.N.; Yadav, Y.S. Effect of tillage practices on yield of rainfed wheat in Doon Valley. Indian J.Agron. Mar- May 1979, 24(1), 72-7.

To explore the possibility of increasing yield of rainfed wheat a study on tillage practices was conducted for 3 years at soil conservation form Dehra Dun. Pooled

Yield indicated that deep cultivation without stubble mulch gave the highest yield (2259 kg/ha). Under lower moisture, deep cultivation gave significantly higher plant population while under optimum soil moisture conditions, tillage practices had no effect on plant population.

YIELD, effect on

54. Reddy, D. Subbārami; Reddy, D. Ramchandra; Chary, Venkala Nadha. A note on the effect of deep ploughing on basic infiltration rate of soils, root growth and grain yields under rainfed agriculture at Anantapur. Ann. Arid Zone. 1977,16(1),149-52.

This experiment consisted two ploughings in the Kharif season, are shallow ploughing (10 cm. depth) by country plough and deep ploughing (30 cm. depth) by a tractor drawn mould board plough in a strip plot design with 6 replications. Experimented crops were, castor (Aruna), red gram (T-21), ground nut (TMV-3) and bajara (HB-3). Maximum intake was observed in deep ploughed fields of castor followed by red gram and bajara. The entire analysis indicated that significantly increased grain yields of castor, redgram and bajara were observed in deep ploughed soils rather than shallow ploughing. Intake rates increased with the depth of root penetration of of the crops and found to be maximum at the stage of crop harvesting.

TECHNIQUES

, IMPLEMENT,COST-LOW

55. Guruswamy, T.; Patil,V.S. A low cost multi-purpose implement for dryland farming. Indian Fmg. May 1986, 36(2),39-41.

A multipurpose implement has been development at the Agricultural Research Station, Bijapur for the dryland farmers. This can be used for sowing different row crops (4 coulters spaced at 20,30 or 40 cm or 3 coulter spaced at 50 or 60 cm), fertilizer application and seed and fertilizer furrow covering in single operation, and a simple attaching device for attaching variable size blades (80,90,100 and 120 cm) for harrowing Results showed that depth of penetration achieved by the harrow blade attached to multipurpose tool bar is nearly 45 percent more than that of local blade harrow, the effective field capacity of implement is reduced to nearly 48 percent due more penetration of the blade, frequent cleaning of the blade and the time lost in turning. The covering attachment of multipurpose implement did not affect the germination of the crop even under receding moisture conditions. It costs only Rs. 600 and weights only 40 kg with the result that it is within the draft capacity of an average pair of bullocks. It can save 40 percent of the operational time, which ultimately helped to save about Rs. 9 per hectare in unit cost of operation.

TILLAGE/FERTILIZATION-SULPHATE OF POTASH,HYDRAULIC WATER CONDUCTIVITY-effect on

56. Reddy, D. Subbarami ; Reddy, D. Ramachandra; Chary,G.Venkata Nadha. A note on the effect of sulphate of potash on hydraulic conductivity, water holding capacity and crop yields under rainfed agriculture at Anantapur. Ann. Arid Zone. 1978,17(2), 236-8.

For an experiment two levels of Potash (50 and 100 kg) K 20/ha) in the form of potassium sulphate and 'no potash. were applied in a randomized block design having six replications. Experiments were conducted on bajara (BH-3),groundnut (TMV.2), Setaria (H-1), and Sunflower (EC 68 415), 20 kg N and 60 kg P_2O_5 were applied for groundnut and 80 kg N and 60 kg P_2O_5 /ha for other crops. The rates of hydraulic conductivity and water holding capacity increased by 25-30% and 10-15 % respectively under all plots provided with 50 kg potash. The root weight of crops also increased by 25-40 % with the increasing dose of potash. Application of K_2O at the rate of 50 Kg/ha significantly increased the grain yield of groundnut, bajara, and sunflower.

CULTIVATION-PROCESS,MULCHING

IRRIGATION WATER, MULCH/TRANSPIRATION,ECONOMICS

57. Gajendra Giri; Singh, R.R. Water consumption and economics of wheat production as influenced by mulch and transpiration suppressants under drylands. Indian J.Agron. June Aug 1984, 29(2),173-8.

An experiment was conducted during 1976-77 and 1977-78 at R.B.S. College Bichpuri, Agra on drylands. The results of the experiment indicated that wheat with the application of mulch, Kaolin and CCC consumed water economically and saved about 35.0, 36.0 and 15.0 mm water against 218 mm used by untreated control. Net returns were high from these treatments, straw mulch increased net profit by 16.8% , Kaolin by 30% and CCC by 50% over control.The rate of moisture use by the rain fed wheat was low under these treatments.

WATER MOISTURE-effect of,CROP-YIELD,AGROECONOMICS

58. Sharma, Pradeep K. ; Kharwara , P.C. soil stored available water and seasonal rainfall as an index of success or failure of rainfed crops. Indian J.of agric.Sci. Mar 1990, 60(3),165-8.

Linear regression equations were developed to predict grain yields of rainfed bread wheat, barley, chickpea and lentil. The crops were grown on a randy loam soil by applying recommended doses of fertilizers. The total water supply accounted 99% in wheat, 95% in barley, 87% in chickpea and 74% in lentil. The values of total water use to produce measurable yields of lentil, barley, wheat and chickpea were 128,142, and 150 mm respectively.

PROCESS, MULCHING-ORGANIC

59. Mane, V.S.; Umrani, N.K. Application of organic mulch at various state of crop growth under dryland conditions. Indian J.Agron. Mar-May 1981,26(1), 1-6.

Study was conducted on winter Sorghum at the dry Farming Research Station, Solapur during 1973-76 to study the relationship between the crop production and the stage of crop growth at which the mulch is to be applied. The maximum advantage of mulch was noticed when it was applied immediately after emergence. In some years mulch improved the growth as well as production which increased from 20 to 120 percent in different mulching treatments. Height of crop, number of functional leaves primodial stage and panicle weight were significantly more when mulch was used at the early stage of crop growth as compared to other stages.

PINE-NEEDLE- effect of,WHEAT-SOLAN

60. Moorti,T.V.; Sharma, R.K.; Singh, C.M.; Sarita. Effect of mulching and seed rate on rainfed wheat (Triticum aestivum). Indian J. agric.Sci. Feb.1989, 59(2), 129-30.

An experiment was conducted during 1982-83 at solan.The moisture requirement of wheat is higher than that of other winter season competing crops like barley.Crop mulching was found to be useful for conserving the moisture. The analysis of mulching treatment showed that maize stoner was not suitable as mulch and the use of pineneedle mulch proved the best. The

use of pin-needle mulch caused the wheat yield to increase by 3.31 kg/kg seed.

STRAW, FERTILIZATION-NITROGEN, NUTRIENT UPTAKE-effect on -BARLEY-VARIETY (RATNA)

61. Agarwal,S.K.; Rajat De. Effect of rates of nitrogen, mulching and antitranspirants on nutrient uptake of barley varieties under rainfed conditions. Indian J. Agron.Mar- May 1979,24(1) 66-72.

A field experiment with barley was conducted on the Todapur Block Farm, I.A.R.I. New Delhi. The N Yield in Straw, grain and total plant was recorded to be significantly higher with straw mulch and Kaolin treatment. Ratna and Vijaya varieties did not differer in yield of N. The yield of N was also increased significantly by the application of 30 kg N/ha over no N.The effect of various treatments on the P yield in straw, grain and total yield was almost similar as N yield.

TRANSPIRATION-CROP-CEREAL,WHEAT.

62. Gajendra Giri; Singh,R.R. Influence of straw mulch and transpiration suppressants on soil temperature, dry matter and total biomass production and nutrient uptoke by dryland wheat. Indian J.agri.Sci. April 1985,55(4),256-61.

Study indicated that straw mulch reduced the fluctuation in soil temperature and increased total biomass production (13.5%), N uptake (24.9%) and p uptake (28.6%) in wheat. Use of CCC and Kaolin increased the biomass production by 24.5 and 17 % and nitrogen uptake by 32.4 and 22.8% respectively, under controlled conditions. The combined application of Kaolin + PMA and CCC increased the P uptake of wheat.

WHEAT,YIELD -effect on -SHIWALIK,FOOT-HILLS-RAINFED

63. Mittal,S.P.; Pratap Singh ; Kehar Singh ; Prahlad Singh. Effect of mulching on yield of rainfed wheat at Shiwalik Foot-hills. Indian J. agric. Sci. 1986, 56 (4),277-81.

A fine years study at Shiwalik Foothills indicated that the grain and straw yields of wheat as well as its water use efficiency increased when straw mulch @ 5 and 7.5 tonnes/ha was applied after sowing of wheat. The beneficial effect of mulch was more pronounced in year of low rainfall.

SOWING-DATES,HYBRIDS-PEARLMILLET, YIELD -effect on

64. Shrivastava, Umashankar Lal. Response of Pearlmillel hybrids to dates of sowing under rainfed condition. Indian J. Agron. June -Aug 1982, 27(2),137-9.

An experiment, consisting of four dates of sowing of pearlmillet hybrids during Kharif 1970 and 1971. The crop sown

in last week of July resulted in higher grain yield than both earlier or later sowings. Data showed that height of plant, number of effective tillers per plant and grain and stoner yield were also affected by the date of sowing. Hybrids HB-3 and BH-4 outyielded D-356 and HB-1 in respective years.

DETES,SPACING,effect of-PEARLMILLET-VARIETIES

65. Kaushik, S.K.; Gautam, R.C. Effect of varying dates of planting and row spacing on yield of pearlmillet varieties under rainfed conditions. Indian J.Agron.Dec-Feb 1984,29(4),480-4.

The field experiment consisted of three dates of planting (first with the onset of monsoon and second 10 and 20 days thereafter) in mainplots and three row spacings (45 x 15, 45 x 12.5 and 45 x 10 cm having 1,33,200, 1,77,600 and 2,22,000 plants / ha , respectively) and three varieties (PSB 8 in 1980, DEC 1 in 1981 and 1982 and DC3 and WC-C75 in all the three years. The study was on the growth and yield of pearlmillet during kharif seasons of 1980, 1981 , and 1982 . Results showed that pearlmillet gave the highest yield when sown with the onset of monsoon that is first fortnight of July. Row spacing of 45x10 cm row spacings. Variety PSB 8 was high yielding than DC3 and WC-C 75.

DIRECT/POTASH-RICE

66. Patiram; Prasad, R.N.; Singh, R.P. Response of rainfed direct seeded rice to potassium on alfisol of Meghalaya. Ann agric.Res 1987, 8(2),214-20.

In the experiments the application of 30 kg K/ha was optimum for production of rice irrespective of available K and N levels in the soil.The yield of rice increased significantly up to 213.5 kg soil available K/ha and this can be considered as the critical level of for this soil. The yield of rice did not increase beyond 50 kg N/ha . The uptake of K and its concentration in straw were also influenced by K application.

DRY

67. Imlate, K.M.S. Dry. Sowing of cotton under rainfed conditions. Indian Fmg. Jan 1970, 19(10), 22-3.

The growers of rain fed cotton in Madhya pradesh should generously adopt timely cotton sowing in dry soil. Cotton seeds were sown on dry soils before the onset of rains as well as at normal sowing time after the reciept of heavy showers. For ensuring a uniform and satisfactory stand of crop, the seed rate may be increased of a month old plants thining may be done to remove congestion and provide for balanced growth of the remaining plants. 'Bhoj', 'Jarila' and 'Indore II' varieties of cotton were recommended.

EARLY,CROPS-GENERAL,YIELDS-EXPERIMENTS

68. Bagga, A.K.; Chakravarty, N.V.K.; Tomar, O.P.S. Crop stand and productivity of early sown rainfed (Barani) wheat. Indian J.Pl. Physiol. 1987, 30(4), 372-9.

Experiment was conducted to see whether the adverse effects of temperature could be mitigated by using (i) suitable plant type or (ii) higher seed rates. A variety 'Hindi 62' known for its relatively better performance under early sown rainfed condition and another high yielding variety HD 2329 were subjected to three sowing dates i.e. + early, normal and late, and three seed rates i.e. 80,120 and 160 kg/ha 'Hindi 62' produced higher productive shoot number and grain yield than HD 2329 in the three sowings. Higher seed rate plots which had larger leaf area and havier crop stands but lower soil moisture at 90 days from sowing and lower water potential and transpiration rate of the flag leaf, gave grain yield similar to the lower seed rate plots.

WHEAT-VARIETY (VL 616), CLIMATIC CONDITION, HILLS, NORTH-WESTERN

69. Jagshoran; Tandon, J.P.; Pant, S.K.; Joshi, H.C.; Koranne, K.D.; Kamta Prasad; Pandey, B.D. 'VL661' A new variety of wheat for early sowing in rainfed areas of North-Western Hills. Indian Fmg. June 1987, 37(3),10-11.

This 'VL 616' variety was evolved by the Scientists working at the vivekananda Parvatiya Krishi Anusandhan Shala. This has solved the long left problems of formers and in built mechanism to save itself from damage due to cold. In co-ordinated tra conducted from 1981-82 to 84 under early sown rainfed conditions,

-METHODS- ROW,OILSEED-SEASAME

70. Rao, K.L. ; Raju, D.V.N.; Rao, C.P. Response of sesame to methods of sowing and row spacing under rainfed conditions. Indian J. Agron. Dec. Feb. 1985, 30(4), 516-7.

Studied the relative merits of dibbling and transplanting sesame at different spacings under rainfed conditions. The treatments comprising two methods of sowing (dibbling and transplanting), three inter-row spacings (15,22.5 , and 30 cm) and two intra-row spacings (10 and 15 cm). The sesame variety 'Madhavi' was used. Dibbling of sesame seeds gave significantly higher yield (7.3q/ha) than transplanting 17 days old seedlings (4.49 q/ha) . wider row spacing (30 cm) recorded significantly higher seed yield than when the row spacing was reduced to 22.5 or 15 cm.

-METHODS -SEEDRATE

71. Nayital, S.C.; Sharma, R.K.; Sharma, Satish C. Response of rainfed wheat (Triticum aestivum) to different seed rates and sowing methods, Indian J. Agric. Sci. Jan 1990,60(1),65-7.

This rainfed field experiment on seed rate and methods of sowing was conducted with 'VL 421' during rabi seasons of 1983-84 and 1984-85. Four methods of sowing were : M1 broadcasting method of wheat, M2, Line sowing of wheat; M3, broadcasting a mixture of wheat and brown sarson and M4, sowing four rows of wheat followed by 1 row of brown Sarson. Without intercrop situation with 1 kg.

increase in seed rate the yield was expected to increase by 20;23,25 and 27 kg through broadcast method , line sowing method without intercrop, broadcast with intercrop and line sowing methods respectively. At 120kg seed rate, the expected yield was estimated to be 2404, 2754, 3018 and 3206 kg/ha under M1, M2,M3 and M4 respectively .

-ROWS-INTER/INTRA, PULSES-CLUSTEREEAN,HARVESTING, YIELD-Comparative study

72. Kackar, N.L.; Daulay, H.S.; Singh,R.P. Effects of inter and intra row spacings on grain yield of rainfed clusterbean. Ann. Arid Zone. 1984,23(1),1-5.

This experiment indicated the effect of inter and intra-row spacings on branched and single stemmed varieties of clusterbeen. During 1978 and 1980 seasons, branched varieties gave higher production in comparision to single stemmed FS 277. In 1980 an acute drought year, closed row spacing (30 cm) gave significant higher yield, the crop sown with the row spacing of 45 and 60 cm intra row spacing of 15 cm gave significant yield over the row spacing of 22.5 cm during 1978 and 1980.

-SPACINGS-ROW, FINGERMILLET,YIELD -effect on

73. Rafey,A. ; Srivastava, V.C. Effect of cultivation, seeding rate and spacing on grain yield of rainfed fingermillet. Indian J. Agron. Sept- Nov 1988, 33(3), 331-2.

A field experiment consisting of two cultivation practices (direct seeding and transplanting) , three row spacings (25,35 , and 45 cm) and three seeding rates (6,8 and 10 kg/ha) of fingermillet. It has been tested that narrow inter and intra-row spacings gave significantly higher yield as compare to wider row spacings in transplanted finger millet.

DRYLAND

CULTIVATION-TECHNOLOGIES

74. Surinder Sud. Dry farming technology. Times of India, Mar 20,1984, CXLVII(79),4.

Our government has started appreciating the need to modernise rainfed agriculture. Optimum plant population and effective weed control have been identified as the two most important measures for pushing up crop production on rainfed farms. Through tillage and use of seed-cum fertiliser drill for planting the seed can lead to between 30 and 40 percent rise in yield. Two crops a year sequences (like Maize-Chickpea, rice chickpea, Soyabean -wheat, etc) can help produce as much as 4 to 5 tonnes of grain/ha, Intercropping is believed to be a boon to dryland agriculture as it reduces the risk of complete crop failure. Availability of

large number of crop varieties with varying maturity durations has made it possible to select the most appropriate crop and strain suited to prevailing weather conditions.

CONTOUR,FERTILIZER-LEVELS,YIELD -effect on,JOWAR

75. Agnihotri, R.C. ; Panwar, K.S. Jowar yield as affected by contour cultivation and fertilizer levels under rainfed conditions. Indian J. Agric. Res. April-June 1979,13(2),65-8

Described the influence of two cultivation practices viz, contour cultivation and cultivation along the slope with three fertilizer levels (No Po N30 P15 and N60 P30) on Jowar yield on sandy clay loam soils of Kanpur during Kharif, 1970-71. Result of the contour cultivation was better and yielded 12.03% more compared to along the slope cultivation. Quality of grain was also better with contour cultivation as indicated by the protein content 60 kg N plus 30 Kg P_2O_5 per hectare recorded 20.66 q/ha while 30 kg N plus 15 kg P_2O_5/ha yielded 18.64 q/ha which were 32.1% and 19,10% more compared to 15.66 q/ha under no fertilizer application.

DROUGHT CULTIVATION-CROPS

OILSEEDS-SAFFLOWER, NUTRITIVE VALUE-MADHYA PRADESH-DRYLAND

76. Nema, D.P. Safflower remunerative in drylands of Madhya Pradesh Indian Fmg. Sept. 1976,27(6),19-20.

Safflower has been found to be one of the most suitable and highly drought-tolerant crops under dryland conditions. It is a very recent introduction as an oil seed crop which has proved its superiority over the rabi crops being most paying and highly remunerative Under barani conditions, The most optimum time for safflower planting has been found to be the second or third week of september. Safflower has been found to be the most remunarative crop after moong, maize, Soyabeen and Cowpea. Its oil being rich in polyunsaturated fatty acids is considered to be desirable from dietary stand point, seed are used for cake preparation. Young safflower leaves are used for good green wegetable and green fodder for livestock. The spiny nature of crop and severe attacks of aphids are the major limitations of its wide adaptability.

REGIONS-PLATEAU

77. Singh, R.K., Prasad, R.B.; Abdul Rafey. Growing Safflower in the drylands of plateau region. Indian Fmg. Mar 1982,21(12), 23-6.

Describes that safflower a oil seed crop is not only feasible to grow, but it can also give fairly good returns even under extreme drought conditions. It has shown good promise in rice-safflower rotation. The duration of preceding

rice varieties should be 90 to 105 days. Loam to clay loam soil is the best for safflower. Except '59-2-1' all the varieties have same yield potential of 8-9 q/ha. 'A 300' and '59-2-1' are the recommended varieties for plateau region of Bihar. Sowing should be done at the seed rate of 10kg/ha with an inter-row spacing of 40 cm just after the 10th October. 20 to 30 Kg. N and if the soil is deficient in phosphate, a dose 20 to 30 kg P_2O_5 may also be applied. Aftercare should be done in order to get maximum beneift.

DRYFARMING

AGRO-ECONOMICS, MANAGEMENT- TECHNOLOGIES

78. Chitnis, D.H. Constraints causing technological gap in dryfarming system. J. Maharashtra agric. univ. 1987,12(1),84-8.

The constraints were grouped in four categories such as : technological credit and economical, service and supply and information transfer. Responses of farmers (big, medium and small) indicated that they had percieved the technological service and supply constraints in the same manner as they were in agreement in ranking them similarly. While they percieved, information transfer and the credit and economical constraints in different manner. The farmers were in need of adequate and timely supply of production inputs, timely advise and training.

COST/BENEFITS

79. Shiv Karan Singh; Reddy, P. Rajeswara. An economic assessment of dryfarming technology, adoption levels , constraints in the transfer of technology : A case study of rainfed caster in Southern Telengana Zone of Andhra Pradesh. Agrl. Situ. in India. Oct. 1987, XLN (7), 619-22.

Study was conducted to achieve the following objectives :(i) to assess the yield- increasing potential of improved dry farming practices (ii) to estimate the economic costs and returns associated with higher Productivity of new technology (iii) to estimate gaps in the potential and actual yields (iv) to identify constraints in the transfer and adoption of improved technology. Results of the experiments indicate immense potential of the recently evolved dryfarming technology. The results of the constraint analysis revealed that inadequacy of capital acted as a serious contraint. Extension services were found to be inadequate and inefficient.

COST/BENEFITS, U.P.-MIDHILLS

80. Arya, S.R.S.; Shah, S.L. New technology of rainfed agriculture and identification of constraints on its adoption in mid-hills of U.P. Agrl. Situ. in India. Oct. 1984, 39(7), 487-9.

A study was conducted in the mid-Himalayan region of U.P. to find out the existing and potential level of food

production and the main constraints in the adoption of new technology of rainfed agriculture. It is seen that by using high yielding varieties and moderate dose of fertilizers the yields of the different crops can be increased from 150 to 300 percent. But there are some constraints in adoption of new technology, small and skewedly distributed holdings, fragmentation and seatteredness of holdings, shortage of women labour, lack of availability of inputs and funds, lack of education, expansion and training.

CROP-BARLEY

81. Tikka, S.B.S. Variability studies in barley (Hardeum vulgareL.) under dry-farming conditions. Ann. Arid Zone. 1978, 17(2), 233-5.

In this experiment ten varieties of barley were grown in 6-rows in randomized block design with 3 replications. The number of useful tillers /plant and spike length had significant heritability, high genetic coefficient and high genetic advance. A wide range of gross variations were noticed in all the characters. Selection of these characters should be done properly for purpose of practical.

AGROMETRY, CROP-MILLETS-MAIZE, MANAGEMENT PRACTICES-UTTAR PRADESH

82. Suraj Bhan; Singh, S.R. Water harvesting and moisture conservation practices for dryfarming of maize and mustard in U.P. Ann. Arid Zone . 1979, 18(1&2), 101-7.

The results of the experiment showed ridging and furrowing, paddy straw mulch combined with chemical control of weeds made the maize 'T41'- mustard 'KB2' rotation successful and profitable under dryland conditions. This inter-row system increased the yield of maize and mustard, and resulted an additonal profit of Rs. 285.60/ha over the conventional methods. Similarly, the paddy straw mulch combined with weedicide increased the yield of maize by 8.4 q/ha and of mustard by 8.7 q/ha and resulted in to an additonal profit of Rs.17.58 per hectare over the control.

RAINFALL PATTERN-INDORE-RAINFED

83. Shanker, U. ; Gupta, V.K. Rainfall pattern and crop planning for rainfed farming in Indore region. Ann. Arid Zone. 1987,26(4), 297-300.

The present paper suggests cropping pattern for the black -cotton soil rainfed region of Indore, where major portion of rain is recievel from the South-West monsoon. On the basis of experimental observations, some inferences were

drawn that (i) The crop varieties of 100 day duration may be grown at Indore, (ii) For sowing of Kharif crops meteriological week26 is suitable which has 70% probability of getting more than 25 mm of rains, (iii) Normal date of onset of monsoon can be as early as 29 May and as delayed as12 July, the late onset reduces the growing period, (iv) crop planning may be done in such a way that the probable period of dry spell may not coincide with the critical stage of crop growth, (v) Moisture should be stored by runoff recycling and use of mulch for the period of early termination of monsoon.

Intercropping systems such as pigionpea + Soyabeen and Maize + Soyabeen, improve the crop production in areas which face breaks in rains frequently.

AGROECONOMICS-AGROMETRY-RAJASTHAN-NAGPUR-DISTRICT

84. Vyas, D.L. Resource use and productivity in dryland agriculture in Nagaur district (Rajasthan). Ann. Arid Zone. 1989, 28(1 & 2),37-45.

Experiments were conducted to examine the resource use and productivity in dryland agriculture in Nagaur district of arid Rajasthan. Study held for 1977-78 to 1979-80 for

three farm size groups by employing production function approach. Marginal value productivity analysis led to inescapable conclusion that all the components of input-mix excepting labour need additive adjustments for enhancement of value productivity of crop output-mix on dryland in Nagaur district.

AGROMETRY-RAJASTHAN-NAGPUR DISTRICT

85. Vyas, D.L. Farm size and productivity relationship in dryland agriculture in Nagpur district (Rajasthan) Ann. Arid Zone. 1989, 28(1&2), 29-35.

This study was carried to examine the farm size productivity relationship in dryland agriculture in Nagaur district of Rajasthan. Experiments were held for three years (1977-78 to 1979-80) by employing correlation and regression methods. There is a scope for soil conservation and irrigation facilities for further increase ment in per hectare productivity particularly on small farms Return to scale in dryland agriculture was broadly positive but predominantly of very low order.

CROPS-PULSES,CLUSTERBEAN-RAINFED

86. Henry,A.; Mathur, B.K. Studies on correlations and path coefficient analysis in clusterbean under rainfed conditions Ann. Arid Zone. 1987,26(3), 157-62.

Study was related with analysis of correlation and path coefficient for grain yield of clusterbean (Cyamopsis tetragonolopa) (Linn.) Taub) in two environments seed yield per plot and per plant were found to be positively and significantly associated with number of pods per plant in both the environments. Plant height had negative association with number of branches while number of branches had positive association with number of clusters per plant. Path coefficient analysis for seed yield per plot carried out at genotypic level revealed that character like higher number of pods per plant with more number of branches, 100 seed weight and number of seeds per pod with medium early maturity and medium dwarf plant will give more yield per plot in seasons having early early cessation of rains. The attributes like. The plant type which have medium tall in plant height , late in maturity and high seed yield per plant together with more number of pods/plant, clusters per plant, seeds per pod and 100 seed weight will result in higher level of seed yield per plot in case of clusterbeen in environment with relatively better distribution of rains.

CROPS-FIBER ——COTTON,MANAGEMENT-TECHNOLOGY

FERTILIZATION COST/BENEFITS

87. Subba Rao, D.V; Chawdry, K.R. ; Satyanarayana, A. An economic analysis of fertilizer use on dryland cotton Farms. Agrl.Situ. in India . Jan 1987, XLI (10), 807-11.

The farmer's misconception that fertilizer use could be harmful on dryland forms has ben dispelled after the introduction of high yielding and hybrid varieties. Fertilizer is considered to be one of the most important component of yield increasing technology under rainfed conditions. The percentage share of fertilisers in total cost of cotton cultivation was 14.47 and 13.78 in over all straight and hybrid cotton farmers. The rate of net returns per rupee investment on fertilisers was rupees 1.78 and 2.10 on overall straight and hybrid farms, respectively. Results indicated that reduced levels of N.P.K nutrients should be used to obtain profitable returns.

MANAGEMENT-ECONOMETRY-ACCOUNTING.

88. Gundu Rao, D.S.; Bisaliah, S. ; Chandrashekar, H. Accounting for productivity differential in dryland agriculture: An econometric exercise. Indian J. Agric. Eco. 1985,XL(4),536-44.

Paper studied the differentials of growth of cropoutput and and productivity. Two streams of studies could

be traced, first, that involves two distinct production process, which refers to time- series production analysis. Second, two distinct technologies operating at a given point in time, that is cross-section production analysis. The major focus of the present study has been to account for productivity differentials of about 23 percent with the introduction of new planting technique in local variety ragi farms and of about 45 percent with the introduction improved ragi varieties in local ragi variety farms. The upward shifts in the production function with the introduction of transplanting method of planting and of improved ragi varieties have been substantial enough to indicate efficiency gain in production. Study has also indicated that more capital services could be employed profitably on both IRV and TLV farms. The productivity partitioning model developed in this study could be effectively used for measuring the contribution of technological and market parameters to productivity growth.

CLIMATIC CONDITION

AGRICULTURE DRYFARMING GENERAL INDIA

89. Ramasastri, K.S.; Ramanamurty,V. Evaluation of soil moisture in dry farming areas in India by climatic water balance. Indian J. agric. Sci. Oct 1975,45 (10), 452-60.

Study indicated the weekly computation of the values of evapotranspiration in Indian dry-farming areas at 73 observatory stations in 18 meterological sub-divisions under normal climatic conditions. From this computation, the weekly water balance has been workedout, resulting the value of soil moisture recharge, soil moisture utilization, and water deficit. In North-west part of India rainfall is adequate to maintain the optimum soil moisture in summer season. In winter adequate soil moisture is available in Tamilnadu, Panjab, East Rajasthan and some parts of Andhra Pradesh for successful crop production. Shallow rooted crops may be grown in east Rajasthan , central Maharashtra and parts of Karnataka during Summer season because these require less water. Hence, these areas are suited for dry-farming.

EVALUATION, CROP-MAIZE, VARIETIES, FORAGE-EXPERIMENT

90. Gill, A.S.; Patil, B.D.; Yadav, C.L. Evaluation of Maize varieties for fodder yield under rainfed conditions. Agric. Sci.Dig. 1986, 6 (4) , 189-91.

Experiments were conducted to study the relative performance of maize varieties for forage yield during seasons of 1977-78 under rainfed conditions at Indian Grassland

and Fodder Research Institute Jhansi. VLT1, JML603 and Kisan varieties of maize were found to be more forage yielding.

CROP CEREAL

FERTILIZATION, NITROGEN. Application - BARLEY.

91. Jha, K.N. ; Ojha, S.N.; Singh, B.D. Response of barley varieties to level of nitrogen under rainfed condition. Indian J.Agron. Mar-May 1981, 26(1),97.

The Experiment comprised of five varieties (K141,P302, K 169, K 125 and Ratna) and four levels of nitrogen (0,20,40 and 60 kg N/ha). The full dose of nitrogen was applied at the time of sowing with an uniform application of 20 kg each of K20 and P_2O_5. The crop responded significantly with the increasing levels of nitrogen up to 60 kg N/ha under rainfed condition.

FERTILIZATION, NITROGEN Application- BARLEY

92. Singh,R.P.; Jagdish Seth; Sharma, S.K. Nitrogen uptake, grain yield and its attributes in rainfed barley as influenced by modes of nitrogen (Urea) application. Indian J. Agron. June Aug.1979,24(2), 138-46.

A field experiment was conducted on a Sandy loam soil at I.A.R. J.; New Delhi during rabi season of 1976-77 and

1977-78, to assess the effeciency of applied N (30kg /ha) as urea in different in different methods on barley.The yield attibutes like tillering, final earheads per metre, ear length and number of grains/ ear and finally the grain and straw yields were found significantly increased due to placement of all N at the time of sowing than its broadcast on soil at sowing or spraying or dusting on foliage after 45 days. The placement method of N, significantly increased the protein % and nitrogen uptake in grain and straw over the other methods of N application.

HORMON/ANTI-TRANSPIRANTS, WHEAT-EXPERIMENT-MIDHILL, HIMANCHAL PRADESH

93. Bhopal Singh ; Awasthi, O.P. Effect of time of application of antitranspirants on the yield of rainfed wheat under mid-hill conditions of Himachal Pradesh. Indian J.Agron. Sept -Nov 1984, 29(3), 363-6.

This experiment studied the effect of transpiration suppressants (Cetyl alcohal, phenyl, Marcuric Acetate, Steeric Acid and chlormequate chloride, on the yield of wheat and to find out the best time of their application (spraying at boot, heading, anthesis, boot + heading, boot + Anthesis, heading + anthesis, boot + heading + anthesis and no spray) in rainfed wheat. Spraying of TS at boot + anthesis stages significantly increased the grain and straw yield of wheat overother stages

of application during both the years and recorded additional yields of the order of 22-7 q grain and 28.0 q straw per hectare over no spray.

NITROGEN, DOSAGES-RICE

94. Kumar, S.D.; Sharma , H.C. Response of Direct Sown Rice to levels of nitrogen under rainfed conditions. Indian J. Agron. Dec. Feb 1980, 25(4), of 17-8.

An investigation was carried out during Kharif 1974-75, to study the response of direct sown rice varieties saket 3, Ratna and CR 4.4-1 to 5 levels of nitrogen viz. 0,20,40,60 and 80 kg /ha. The recommended dose of N with 40 kg P_2O_5, 30kg K_{20} was placed 10 cm deep in seed furrow before seeding. Ratna was highest yielder folowed by Saket 3 and CR4.4-1 . Significant yield increase were observed up to 40 kg N/ha.

DRY-SOWING, RICE,UPLAND

95. Sharma, R.S.; Rathi,G.S.; Choubey, S.D. Agronomic practices for raising productivity of rainfed upland rice. Indian Fmg. May 1986, 36 (2), 16-8.

A 3 year study was conducted to find out suitable practices for raising the productivity of rainfed upland rice. The entire cultivation of upland rice depends upon the vagaries of monsoon.Fertilizers are rarely used for tall varieties and if used with higher dose, the crop suffers from lodging. Newly evolved short duration dwarf varieties should be selected because of high yielding

and responsive to considerable doses of fertilizers without lodging. Direct seeding of rice as dry sowing, is followed in upland rainfed areas. Performance of early maturing dwarf varieties showed that drilling of seeds at 75 kg per hectare in rows 20 cm. apart was proved to be a promising method of rice cultivation. The fertilizer dose should be applied up to the level of 90:60 kg per hectare NPK. P and K fertilizers should be applied at the time of sowing, whereas nitrogenous fertilizers should be applied in different splits. For controlling the weeds application of oxadiazon at one kg a.i. per hectare pre- emergence + propanil at 2 kg a.i. per hectare as post emergence were proved to be considerably good and economical. The early ripening variety (85 -90 days) 'purva' performed well. The other varieties namely 'CRM 13-3241' 'DR 92' and 'JR 75' also yielded more than the average production within a duration of about 100 days.

N.P.-PLACEMENT -effect of RICE

96. Singh, O.P.; Singh, R.A. ; Mahatim Singh .Effect of comp action and nitrogen placement on yield and nitrogen uptake by rainfed rice and wheat. Ann. Arid Zone. 1978,17(2), 123-32.

Field experiments were conducted with the three levels of compaction and three depths of placement of nitrogen under rainfed conditions. The compaction treatment did not show any significant increase in the concentration of nitrogen and protein percentage of rice and wheat. Soil

compaction influenced the nitrogen uptake by rice and wheat Placement method was found useful for the application of nitrogen in the rice crop. Wheat yield was significantly affected by placement of nitrogen .Deep placement of nitrogen resulted higher nitrogen content and protein percentage in grain and wheat straw.

NITROGEN -Application-WHEAT/OAT-UTTAR PRADESH -EASTERN

97. Singh, U.N. ; Singh, R.A. Response of rabi cereats to levels and methods of nitrogen application under dryland conditions of eastern U.P. Ann.Arid Zone. 1975,14(2),159-66.

In dryland conditions, barley was found the most suitable rabi cereal as compared to wheat and oat. The Crop responded significantly up to 90 kg N per hectare and better utilization of nitrogen at lower rates as compared to higher rates. This significant use and response was due to instalmented application of Nitrogen as basal 60 kg N /ha + 30 kg N/ha by foliar spray. Split application of nitrogen in the combination of foliar and basal placement was more economical.

N.P.K. Application- WHEAT-FIELD-TRIAL-JHANSI

98. Gahlot, K.N.S.; Ram Vishal; Viswakarma, S.J. Fertilizer application in rainfed wheat. Indian J.Agri. Res. Jan- Mar 1978, 12 (1), 57-8.

A field trial was conducted at Regional agriculture testing & Demonstration Centre, Jhansi (U.P.) during the year 1978-74 and 1974-75, on wheat Kalyan Sona. A basal dose of 20 kg P_2O_5/ha and 20 kg K_2O with 40 kg N through placement at planting is the best practice for enhancing the wheat yields under rainfed conditions. In case, the fertilizer is in short supply at sowing, 20 kg N may be drilled at sowing and remaining 20 kg N may be applied as N foliar spray at tillering and preflowering stage of wheat crop.

NITROGEN, CROP CEREAL WHEAT

99. Kamta Prasad; Tandon, J.P. Response of rainfed wheat to nitrogen. Indian J.Agron. Dec- Feb 1984, 29(4),547-8.

In a field experiment conducted, wheat variety VL 421 was sown on 25 October and 27 October respectively in 1980 and 1981. Nitrogen rates were 0,10,20,30 and 40 kg N/ha Total dose of nitrogen as urea and uniform dose of 30 kg P_2O_5/ha as Single Superphosphate were applied. Results indicated that a marked increase in grain and straw yield was recorded with nitrogen over no nitrogen.

WHEAT-VARIETIES-KULUVALLEY (H.P.)

100. Singh,C.M.; Modgal,S.C.; Tashi Dawa; Sood, B.R. Response of rainfed wheat to nitrogen fertilization in Kulu valley (H.P.). Indian J. Agron. Mar-May 1979,24(1), 27-31.

A field experiment was conducted under rainfed conditions during rabi season of 1975-76 and 1976-77 at the cereal Breeding Sub-station, Agricultural complex, Kulu (H.P) The study was with five wheat varieties (S-308, Bajaura-1, Firija, Shailja and LSW-110)and four levels of nitrogen (0,30,60 and 90 Kg N/ha). The crop responded significantly up to 90 kg N/ha. 'Shailja yielded significantly in comparison to other varieties. The profitable level of nitrogen was 118 kg per hectare and the optimum yield on the basis of pooled analysis was 3350 kg/ ha.

DOSAGES-GENERAL -VARIETIES /HYBRID-GUJRAT

101. Gopani, D.D. ; Paida, V.J.; Patel, R.D. Dryfarming practices in Gujrat Indian Fmg. Mar 1971, 20 (12),13-6.

The research work on dryforming practices was started on Targadia, District Rajkot during the year 1959-60. The soils of this tract are loamy with annual rainfall of 500 mm. Trials were conducted on Hybrid Jowar CSH1, Hybrid bajara 104, castor, Sesamum Murg, Groundnut, Soyabeen, Sunflower flungary, Mung J.1, Cotton Sanjay. Package of practices for groundnut is, moisture of soil should be conserved by countour bunding. Sowing of Junagadh 11(bunch) varietiey at the rate of 74 to 86 kg per hectare at 30-45 cm. row spacing should be done. with 6 tonnes of F.Y.M. , 12 kg N and 25 kg. P_2O_5 per hectare before sowing in one dose is applied. Interculturing should be done if needed. The variety

Junagadh 11 yielded 9 percent more pods than A.K.12-24 and yield of hybrid bajara 104 obtained at seed farms proved very good under the dry farming practices.

NITROGEN,MANAGEMENT -COTTON

102. Jeyaraman, S. Nitrogen management in high yielding cotton under rainfed conditions. Indian J. Agron. Dec- Feb 1988, 33(4), 456-7.

In this experiment a fertilizer dose of 40 kg N+20 kg P_2O_5/ha was given .The entire dose of P_2O_5 as basal and N as per treatment were applied. Seeding was done by seed-drill with a row spacing of 60 cm. The band placement of 50% N in two splits recorded significantly higher seed yield over complete basal application.

PHOSPHORUS,FORAGE-SETARIA SPHACELATA-First introduced.

103. Rai,P. ; Kanodia, K.C. Response of Setaria Sphacelata to nitrogen and phosphorus under rainfed conditions. Indian J. Agron. June- Aug 1981,26 (2), 205-6.

This setaria Sphacelata (grass), a native of Africa was first introduced in India in 1950 at Indian Agricultural Research Institute, New Delhi. An experiment was conducted to know the response of N and P under dryland conditions at central Research Farm of Indian Grass land and Fodder Research Institute, Jhansi. Five levels of nitrogen

(0,30,60,90 and 120 kg N/ha) and 3 levels of Phosphorus (0,30 and 60 kg P_2O_5/ha) were laid out in randomized block design with three replications. Forage production revealed that there was a significant response of N and P on the green and dry matter production. The dry matter yield increased by 60.6, 63.9, 87.9 and 115.2 percent with application of 30,60,90 and 120 kg/ha respectively.

PHOSPHATE,IRRIGATED-WHEAT-MAHARASHTRA.

104. Nirale, A.S. Phosphate uptake by wheat (triticum species) varieties grown under irrigated and rainfed regions of Maharashtra. Indian J.Agric. Sci. Dec. 1988, 58 (12),939-40 .

This study was conducted to assess the growth and P uptake of wheat varieties in relation to moisture stress. 'Kalyan Sona' bread wheat and 'Malvika' macaronic wheat are high yielding varieties under irrigated condition, whereas 'N15439' 'N1 5643', 'N59' and 'N1 146' are rainfed varieties 'Gulab' and 'Moti' are local selection in rainfed conditions. Higher uptake by 'Kalyan Sona ' and' 'Malvika ' was due to their lower shoot: root ratio, greater root growth and higher mineral uptake efficiency.

POTASH-DOSAGES-Effect of-WHEAT (Kalyan Sona)

105. Dwivedi, D.P. ; Misra, N.M. Response of wheat to potash fertilization under rainfed condition. Indian agric. 1986,30(1) 89-91.

A field trial with three doses and five methods of potash application was conducted at two locations to

investigate the suitable dose and methods of potash application in enhancing wheat yield under rainfed conditions. 40 Kg K20 applied as ½ basal +½ foliar in equal splits at tillering and jointing stages gave the highest grain yield of wheat variety 'Kalyan Sona' at both the locations.

POTASSIUM-Residual effect of -WHEAT (Bread)

106. Nakashgir, G.H.; Khan , G.M., Rafique, M.M.; Wani, S.A. Effect of Potassium fertilization on winter hardiness and yield of bread wheat (Triticum aestivum) and its residual effect on greengram (vigna radiata) under rainfed conditions. Indian J. agric Sci. Sept. 1988, 58(9),704-6.

A 2- year field study conducted in 1984-86 to investigate the effect of K on tolerance of winter death in wheat and drought resistance in greangram during summer in silty-clay-loam soils. The treatment included 2 rates of K (15 and 30 kg /ha) with different combinations of N and Farmyard manure. Application of K increases the concentration of cell-sap and is much useful to induce winter hardiness in wheat . Residual effect of K on green gram was significant (20%) in the presence of F.Y.M. under severe drought.

CLIMATIC CONDITIONS, CROPS-MILLETS

FERTILIZATION-CHEMICAL/FYM-MAIZE-YIELD -effect on

107. Grewal, S. S.; Sud , A.D.; Mittal, S.P.; Kehar Singh. Effect of Farm Yard Manure and Chemical Fertilizers on yield of rainfed maize in Siwalik Foot Hills. Indian J. Agron Sept-Nov 1982,27 (3),282-3.

An experiment was conducted at Chandigarh during Kharif season of 1978 with four doses of nitrogen, phosphorus, and potash (30:15:15;60:30:30;90:45;45; 120:60:60) and combination of FYM with these doses FYM at 10 tones per hectare was added. The entire phosphorus and potash and half of N was applied at sowing and remaining half of N was applied as topdressing 30 days after sowing. Maize-Ageti- 76 was sown at 60x30 cm. spacings. The crop yield increased from 12-2 q/ha to 18.7 q/ha with 10 tones/ha F.Y.M. A substantial increase in yield was obtained when the dose was increased from 60:30:30 to 90:45:45 levels.

NPK-BAJARA/GRAM

108. Brar, J.S. ; Rana, D.S.; Sharma, K.N.; Meelu , O.P.; Sodhi, J.S. Effect of NPK application on the yield of bajara and gram under rainfed conditions. Ann. Arid Zone 1980, 19(1&2),19-28.

The experiment indicated that in the first year of low rainfall and low moisture storage of surface soil at sowing of the crops, the grain yield of bajara

was nearly half and of gram was one fifth to half of the second year. Bajara showed significant responses to N up to 90 kg per hectare and P up to 45 kg P_2O_5 per hectare in the second year, but in the first year, the significant responses to N and P were only upto 30 kg N and 15 kg P_2O_5 per hectare respectively. The gram gave significant response to 40 kg P_2O_5per hectare when applied alone, but response in the presence of N was significant only up to 20 kg P_2O_5 per hectare during both the years. A balance dose of N,P and K fertilizers gave economically better grain yield in both the crops.

MANAGEMENT-PHOSPHATIC/POTASSIC-YIELD-effect on - MAIZE (Hybrid)

109. Jain, G.L.; Singhi, S.M.; Sharma, H.N.; Mehnot,S.C. Management of phosphatic and potassic fertilizers for hybrid and local maize under rainfed conditions of South-East Rajasthan. Indian J. Agron. Mar-May 1982, 27(1), 41-7.

The experiment was conducted with 3 maize varieties (Local malan, Bassi- Selected and hybrid Ganga-5), 4 levels of P (0,15,30 and 45 kg P_2O_5 /ha) and 5 levels of K(0 and 50 kg K20/ha) was conducted during Kharif seasons of 1972-73 and 1974-75. The optimum dose determined was 44.6 kg. P_2O_5. Results showed that variety Bassi out -yielded local Malan in the first season while Ganga -5 was superior in the second season.

MICRONUTRIENT - effect of -PEARLMILLET.

110. Aggarwal, R.K.; Panjab Singh. Effect of Zn and P levels on the concentration and uptake of N and N/Zn ratio in rainfed pearl millet (Pennisetum typhoides S & H). Ann. Arid Zone. 1978, 17(3), 267-72.

Field experiment indicated the effect of soil applied Zn (0,15,30 Kg) by commercial Zn SO_4/ha and P (0,30,60,90 kg P_2O_5/ha) on N concentration and uptake, and N/Zn ratio in pearl millet revealed that the concentration and total N uptake increased with the increase in the levels of Zn and P, but decreased when higher level of one element combined with low level of another element. Under drought conditions the concentration increased and total uptake decreased during crop growth. N/Zn ratio in grain was more in comparision to straw or root. Decrease in N/Zn ratio adverssally affected the quality and quantity of grain.

NITROGEN-Application of -BAJARA.

111. Singh,S.D. Method and timing of nitrogen application in rainfed bajara. Ann. Arid Zone. 1976, 15(4), 305-12.

Experiments were conducted over three seasons to integrate timing and method of nitrogen application to bajara. Observation showed that the affectiveness of fertilizer is maximum and risk in the use of fertilizer

is minimum. Results indicated that 30 kg of N/ha can be added at sowing and 15 kg N can be used later as topdressing under normal rainfall conditions. In absence of spray facilities 15kg nitrogen can be applied as top-dressing in dry conditions. In this case only 30 kg N/ha is recommended to be used by basal dressing. Selection of time and method of using nitrogen minimises the risk in use of fertilizer.

DOSAGES-PEARLMILLETS -RAINFED

112. Upasani, R.K.; Sharma, H.C. Response of pearl-millet to nitrogen fertilization under rainfed condition. Indian J. Agron. Dec. Feb 1980, 25(4), 727-8.

A field trial, to study the response of pearlmillet HB -5 to nitrogen application, was conducted at Research Farm , Banaras Hindu university, during Kharif 1977. Six levels of nitrogen (0,20, 40,60,80 and 100 kg N/ha) were replicated thrice in Randomised Block Design. The crop was sown in rows 45 cm apart using 5 kg seed per hectare Grain yield due to 20 and 40 kg N/ha were comparable to that without nitrogen. Similarly. 20,40 and 60 kg, 40,60 and 80 kg ; 80 and 100 kg nitrogen rates were comparable among themselves in this respect.

METHODS-YIELD, effect on -BAJARA (HB 3)

113. Singh, R.P.; Daulay, H.S. ; Singh, K.C.; Gupta B.S. Effect of rates and methods of nitrogen application on the yield and yield attributes of rainfed bajara HB3 grown in the arid zone. Ann. Arid Zone. 1978, 17(2), 136-44.

Study conducted for two years indicated the response of rainfed bajara HB3 to four levels of nitrogen (0,40,80, and 120 kg /ha) and efficiency of different methods of nitrogen application viz broadcast and incroproated, placement 10 cm. deep, placement 5 cm deep and 5 cm to the sides, half soil and half foliar, three fourth soil and one fourth foliar, half placement and half topdressing. The optimum use of N for rainfed conditions to bajara HB 3 calculated 47 to 55 kg/ha. Use of 40 kg N/ha either by broad cast and incorporated or placed 10 cm. deep at the time of sowing resulted in increased grain yield of the order of 44 to 96 %. over the unfertilised control, half soil and half top dressing method of nitrogen application proved to be most efficient. Half of the nitrogen 20 kg N/ha used through placement 10 cm. deep at the time of sowing and remaining half (20 kg N/ha) as top dressing 35-40 days after sowing, was found more economical.

N/P -DOSAGES-KODO-Experiment

114. Kaushik, S.K.; Gautam, R.C. Response of millet Kodo varieties to nitrogen and phosphorus levels under rainfed conditions, Indian J. Agron. June-Aug 1981 , 26(2), 168-70.

The experiment comprised of 4 levels of nitrogen (0,20, 40, and 60 kg /ha) and two levels of P (0 and 20 kg /ha) to assess the response of 3 Kodo millet (Paspalum scrobiculatum L.) varieties (IPS-147-1, JNK- 364 and Kherpur) under rainfed conditions Results showed that JNK - 364 yielded higher grain and all varieties responded significantly to N up to 60 kg and P up to 20 kg. The 54 kg N/ha was found optimum economically while the yield was maximum at 60 kg N/ha.

N,P.K. DOSAGES-SORGHUM -VARIETIES (CSH1&2 Local NJ 164)-Comparative Study.

115. Nagre, K.T. Response of Kharif Jowar (Sorghum) varieties to varying levels of N.P.K. under rainfed conditions . Indian J.Agri. Res. July-Sep 1981, 15(3), 166-70.

Experiments indicated that hybrids CSH-1 and CSH-2 were at par and recorded significantly more (55.3% and 41.0 % respectively) yield than local improved variety N.J. 164. During drought year CSH-1 was better than CSH-2. Local varieties responded up to 60 kg N per hectare whereas CSH-1 and CSH-2 responded upto 120 Kg N/ha. CSH-1 gave 23.0 and 19.28 kg response to per kg of nitrogen at 60 and120 kg N/ha as against 8.68 and 5.53 kg obtained from NJ 164. use of phosphate at 60 kg P_2O_5/ha was also found effective.

NPK,GENERAL -CROPS

116. Patel, A.R.Fertilizer : a must for rainfed farming. Kurukshetra June 1984, 32(9),24-6.

Earlier attempts to increase the productivity of dryland crops through application of manures and fertilizers did not meet with much success due to the cultivation of traditonal crops and their varieties . Experiments conducted on cultivators field reveal that the benefit from fertilizers when applied in balanced proportion (combined application of N, and K) was much more than the application of N alone or combined with P. under rainfed conditions, it is advisable to apply the fertilizer at the sowing time by drilling. The soil scientist firi and De have demonstrated that previous crops of groundnut, cowpea or pigeonpea increased the yield of subsequently grown pearl- millet. While a yield of pearlmillet after a pearl-millet was linear up to 60 kg. N.

N,P. Zn, WATER-USE/YIELD -effect on-PEARLMILLET

117. Maliwal, G.L.; Patel, R.R. ;Sonani, V.V. ; Sasani,G.V. Effect of nitrogen, phosphorus and zinc on the yield and water use by pearlmillet under rainfed condition, Indian J.Agri. Res. Jan-Mar 1989, 23(1), 15-21.

Discuss the requirement of N, P and Zn by the pearlmillet variety 'C.J.104'. The combination of 75 Kg N and 25 kg P_2O_5/ha gave significantly higher grain and stover yields. Zinc sulphate did not give any response.

NITROGEN-SORGHUM (M.P. Chari)

118. Abichandani, C.T.; Gill, A.S.; Maurya, R.K.; Mannikar, N.D. Nitrogen fertilization of fodder Sorghum M.P. Chari (Sorghum bicolor) grown under rainfed condition. Ann. Arid Zone. 1973, 12(1&2), 71-6.

Experiments were conducted on fodder sorghum (M.P. Chari) under dryland conditions at Indian Grassland and Fodder Research Institute, Jhansi. The nitrogen application both basal and split increased green fodder, Dry matter, crude protein yields over no nitrogen and singnificant increase in yield were obtained by using 90 kg N/ha. Split application of nitrogen did not gave any significant results over basal application. Crude protein content and dry matter was higher in rainfed conditions in comparision to normal rainfall.

SOURCES-Comparative study of -BAJARA

119. Vyas, D.L.; Singh, S.D.; Daulay, H.S.,; Misra, D.K. comparative study of nitrogen sources for fertilisation of rainfed bajara. Ann. Arid Zone. 1972, 11(3&4), 145-53.

Generally, sources did not influence the grain stalk yields of bajara. Use of nitrogen in different plots indicated increase in yield over the control. The collected data for all the seasons the optimum use of nitrogen for local improved variety R.S.K. worked out to be 23.2.kg/ha

and at this level a yield of 397.15 kg and return of Rs.187.48 per hectare can be assumed. By consideration of price per unit of manure or fertilizer, any source of nitrogen can be used for bajara under rainfed conditions of the sandy arid region of Rajasthan.

FERTILIZER
-LEVELS,YIELD -effect on-FOR AGE (MP Chari)

120. Shah, M.H.; Bali, A.S.; Singh, K.N.; Koul, P.K. Effect of levels of nitrogen and phosphorus on forage yield of rainfed 'MP Chari' Sorghum (Sorghum bicolar). Indian J.agric Sci. Dec. 1988, 58 (12), 945-6.

The field experiment was conducted at exotic cattle breeding farm, Manasbal, under rainfed conditions during 1985-86. 'MP Chari' Sorghum was sown at the seed rate of 40 kg /ha in lines with 5 levels of N (0,20,40, 60 and 80 kg/ha) as urea and two levels of P (8.80 and 17.6 kg /ha) as diammonium phosphate. The increase in fresh forage yield at 80kg N/ha was 42.5, 18.8, 6.8 and 2.2% at 0,20 , 40, and 60 kg N/ha. P @ 17.6 kg /ha gave 15.9. and 14.8% increase on fresh and dry yield basis respectively.

RESPONSE,FORAGE, MINOR MILLETS-EXPERIMENT

121. Gill, A.S.; Patil, B.D.; Yadav, C.L. Fertilizer studies on minor millet for forage yield under rainfed conditions. Agric. Sci. Dig. 1986, 6 (4), 202-4.

An experiment was conducted to determine the effect of N levels on the forage yields of minor millets showed that application of nitrogen increased the green fodder and drymatter yields significantly. For good dry matter yield under rainfed conditions optimum dose of N worked out to be 109 and 208 kg/ha for 1976 and 1977 seasons, respecti vely.

CROPS-OILSEEDS

FERTILIZATION-DOSAGES-PLENTY-INDIAN-RAPE-VARIETY (Taramira) RAINFED

122. Gajendra Giri ; Gangasaran. Influence of planting geometry and nitrogen on the performance of Indian rape under rainfed conditions. Indian J.Agron.Dec-Feo 1985, 30(4),470-6.

Described the influence of planting geometry and levels of nitrogen on yield and yield attributes and economics of Indian rape var. Taria. Distant Planting geometry increased pod bearing and productivity of individual plant but dense plant population compensated this effect. Nitrogen improved yield attributing characters and increased the yield. Response to nitrogen was linear upto 60 kg N per hectare in 1981-82 but in 1982-83 and 1983-84, the optimum rate of nitrogen was 39.4 kg and 53.7 kg per hectare, respectively.

FERTO-FUNGISIDE/WEEDICIDE-GROUNDNUT-RAINFED

123. Reddy, P.S. New technology for rainfed groundnut. Indian Fmg. June 1985, 35 (3),14-7.

The production technology generated at different AICORPO grounnut research entres. The technology for increasing Kharif groundnut yields consists of thorough preparation of land, choice of an improved variety, Bold and well filled seeds should be selected and treated with 3 gms of Dithane M-45 per kg of Kernals. Advancement of sowing with one presowing irrigation at 30 x 10 cm distance. It is profitable to apply rhirobial culture in places where groundnut is a new introduction. Normally 10-20 kg N, 20-40 kg P_2O_5 and 0 to 25 kg K_2O with micronutrient zinc, boron and iron is recommended. For weed control, application of herbicides like TOKE -25 or lossoat 5 litres per hectare is recommended Application of life saving irrigation in the absence of single rain during the critical stage of pod development can increase the production. Use of Gypsum at 250 to 500 kg/ha at peak flowering stage will increase yield and oil content of the produce. Disease and pest can be controlled by spraying of Carbandazim 0.05 percent plus Menacoreb 0.2 percent 2 to 3 tinnes and mona crotaphos or Dimethoate 0.05 percent (Cost benefit ratio). Harvesting should be done when crop shows symptoms of yellowing of foliage, spotting of leves, dropping of older leaves and pod becomes hard and tough.

INTER-ROW-TILLERING-RAGI

124. Murthy, S.N. Narasimha; Hegde, B.R. Tillering in relation to intra- row competition in ragi under rainfed conditions. Indian J. Agron. Sept. Nov 1981, 26(3), 337-8.

A field experiment was conducted under rainfed conditions with ragi during Kharif season of 1978, to study the tillering pattern and yield as influenced by intra-row spacings and fertility levels. The treatments comprised of six populations in 25 cm. row spacings (2.66, 3.20,4.00 5.34, 8.00 and 13.5 lakh plants / ha) and three levels of fertilizers (no fertilizer, 25+25+12.5 kg N,P_2O_5 and K_2O /ha and 50 + 50 + 25 kg N, P_2O_5 and K_2O/ha). Results revealed that the main shoot contributed 25 percent of the total grain yield followed by primary (24 percent), secondary (13 percent) and testiary (12%) tillers. wider row spacing of 25 cm gave the highest grain yield from individual plant (33.6 g/plant).

MANAGEMENT/ APPLICATION-SUNFLOWER

125. Krishnegowda, K.T.; Siddegowda, B.S. ; Siddappa, B. Response of rainfed sunflower to different management practices. Indian J. Agron. Sept- Now 1979, 24(3), 359-60.

In this study the sunflower variety EC. 68415 was raised under three management practices viz (i) in the farmers' method

a fertilizer dose of 20N + 20 P_2O_5 + 10kg K_2O/ha was given at sowing (ii) a higher fertilizer dose (37.5N + 50 P_2O_5 + 37.5 K_2O Kg/ha) was applied of the total N applied 2/3 was given at sowing and the remaining the top dressed 40 days after sowing (iii) included pre-sowing seed hardening, higher fertilizer application (50 N + 90 P_2O_5 + 40 K_2O kg/ha) nitrogen fertilizer was applied in two splits. TIBA (Tri-iodo Benzonic acid) spray at 120 ppm at first flower opening was administered . Results showed that Advanced method was found much effective than others.

NITROGEN , MANAGEMENT -TECHNIQUES-SUNFLOWER

126. Karunakaran, A. ; Palaniappan, S.P. Evaluation of nitrogen management techniques for rainfed sunflower (Helianthus annus). Indian J. Agric. Sci. Oct. 1989, 59 (10), 671-3.

This study carried out evaluate the N management techniques to increase the production of Sunflower. The experimental soil was sandy loam having low amount of N (245 kg/ha), medium amount of P (12 kg per ha) and high amount of K(625 kg/ha). The rainfall received during experiment was 329 mm. The sunflower was intercropped with 'CO1' soyabeen. Azospirillum was inoculated with 4 levels of N (0,20, 30 and 40 kg N/ha). The sole crop of sunflower had large head size, higher number of filled seeds /head than the crop intercropped with Soyabeen , Growth and yield increased with the increasing supply of Nitrogen upto 30 kg N per hectare.

NPK-effect on -GROUND NUT

127. Jana, P.K. ; Barik, A. ; Ghatak, S.; Mukherjee, A.K., Sounda, G. Effect of nitrogen , phosphorus and Potassium on yield and Yield attributes of rainfed groundnut (Arachis hypogea). Indian J. of agric Sci. Jan 1990, 60(1), 49-51.

A field experiment was conducted during the Kharif seasons of 1986-87 with 'JL 24' groundnut at Kalyani, to findout the effect of N,P and K on yield and yield attributes in rainfed conditions. Application of N and P increased the pods/plant, Kernels /pod , 100 -Kernel weight and pod yield. N @ 20 and 40 kg /ha gave 1.46 and 1.48 tonne per hectare. P @ 17.60 and 35.20 kg/ha increased the pod yield compared with the control by 0.36 and 0.47 tonnes /ha respectively. The sufficient dose of N30.16 kg /ha and of P 37.09 kg/ha was found beneficial.

NITROGEN,RESPONSE,SAFFLOWER-

128. Umrani, N.K.; Kale, S.P. ; Bhoi, P.G. Response of Safflower to application of nitrogen under rainfed conditions. Indian J. Agron. Dec. Feb 1981,26(4), 365-70.

The experiment was conducted for three years from 1973-76 at the Dryfarming Research Station, Solapur to study the response of Safflower to nitrogen under rainfed conditions. Application of nitrogen to rainfed safflow affected the crop

characters like, height, number of primary branches, number of capsules per plant. Nitrogen also increased grain weight per capsule and number of grains in it. In normally distribu ted rainfall year the good response was noticed even at 25 kg N/ha Pooled analysis showed that at 25 kg N level maximum response to nitrogen estimated as 15.8 kg grain / Kg N applied was noticed. There was significant increase in yield of sallower grain even at 75 kg N/ha under rainfed conditions.

YIELD-IMPROVED-MUSTARD

129. Prakash vir ; Verma, B.S. Effect of rates and methods of nitrogen application on the growth , yield and quality of mustard under rainfed conditions of Agra region. Indian J. Agron. June -Aug 1979, 24(2).

An experiment to study the effect of rates and methods of N application on the growth, yield and quantity of mustard under rainfed conditions was conducted at the R.B.S. College Research Farm, Bichpuri, Agra during winter seasons of 1974-75 and 1975-76. Two levels of N (30 and 60 Kg N per hectare) and three methods of N application (full dose of Nasbasal, 3/4 as basal + ¼ faliar and ½ as basal + ½ foliar) with two additional treatments , one for absolute control and another for water spray were comapred in randomised block design on 'T-59' variety of mustard. The increased supply of N affected favourably the number of primary and secondary branches per plant, yield attributes, seed yield, percent N content in seed and stoner

and the total uptake of N through crop, while percent oil content in seed remained unaffected.

CLIMATIC-CONDITIONS

FERTILIZERS-DOSAGES,N.P.K. FRENCHBEAN-HILLS NILGIRI

130. Singh, K.N.; Prasad , R.D.; Tomar, V.P.S. Response of French Bean to different levels of nitrogen and phosphorus in Nilgiri Hills under rainfed conditions. Indian J.Agron. Mar-May 1981, 26(1), 101-2.

The experiment was laid out in randomized block design with three levels of nitrogen (0,10 and 20 Kg/ha) and four levels of phosphorus (0,30,60 and 90 kg P_2O_5/ha and replicated three times. Results indicated that grain yield of French been increased as the rate of nitrogen increased. It has been reported that nitrogen in combination with phosphorus gave significant grain yield of gram. Application of phosphorus at 60 and 90 kg P_2O_5 per hectare were significantly superior than 30 kg P_2O_5/ha in terms of grain production of French bean.

NITRATES/NITRO-AMIDES/SULPHATES-RAGI

131. Ananthanarayana, R.; Krishnamurthy, K.; Dixit, L.A. Effect of different nitrogenous fertilizer on rainfed ragi, Ann. Arid Zone 1971, 10(1), 43-7.

Experiments were conducted to investigate the effect of four types of nitrogenous fertilizers viz. Ammoniasulphate nitrate, Ammonium Sulphate, Urea, Calcium nitrate, on the grain yield of ragi cv. H-22 under rainfed conditions . Each of these fertilizers was used at 33.3kg and 100 kg N per hectare. The complete dose of fertilizers was used at the time of transplanting. The calcium ammonium nitrate was determined as the best source of nitrogen for increasing the yield of rainfed ragi. Although the yield was maximum by applying 100 kg N per hectare but it was not much significant as compare to application of 33.3 Kg N per hectare.

NITROGEN-Application of, DOUBLE CROPPING-IMPROVED

132. Sharma, S.N.; Prasad, R.; Singh, S. Legumes for nitrogen economy and double-cropping under rainfed conditions. Indian J. agri.-sci. Dec. 1987, 57 (12),899-904.

This experiment was conducted in I.A.R.I. New Delhi to explore the possibility of growing 2 crops a year in place of traditional 1 crop, by natural precipitation. During the monsoon season, short duration legumes like-cowpea (vigna unguiculata Linn.) could be grown successfully without disturbing the grain yield of previously grown wheat crop in winter season. The grain yield of wheat increased when these legumes were grown for green manuring Such practices give equal benefits as applied 40-80 kg N/ ha to wheat after monsoon fallow.

PHOSPHATE, SOWING SPACING -effect of-CROP-ARHAR

133.Masood Ali. Effect of row spacings and phosphorus levels of Arhar production under dryland conditions. Indian J. Sept. Now.1981, 26(3), 346-8.

A field experiment was conducted at Dryland project centre , Indian Grassland and Fodder Research Institute, Jhansi during Kharif 1977 to find out optimal row spacing and phosphate levels for high yielding cultivars of Arhar. Treatment consisted of varieties 'HY 1' and 'Pusa Ageti', row spacing (45 and 60 Cm.) and phosphate levels (20,40 and 60 kg P_2O_5/ha). The entire dose of phosphorus and 20 kg/ N/ha was applied at seeding time through placement . Wider row spacing (60 cm) was found to be significantly better than narrow spacing (45 cm) with respect to grain yield. It is suggested that higher production of Arhar could be obtained by Hy.1 at 60 x 15 cm. spacing and fertilizing it with 20 kg N plus 40 kg P_2O_5 per hectare.

PHOSPHORUS-effect of -COWPEA

134.Muthuswamy, P. ; Natesan,R.; Narayanan, A. Response of Cowpea to phosphorus application under rainfed condition. Madras agri.J. 1986 ,73(5), 268-70.

Effect of three levels of phosphorus (0.20 and 40 kg/ha and two levels of molybdenum (0 and 1 kg /ha) on yield ,

production of root nodule and uptake of p were studied for two seasons in Cowpea under rainfed condition. Phosphorus application at 20 kg per ha had consistently registered highe- grain yield. Cowpea crop was found to remove 12 p kg/ha of which 45 % is utilized for grain production no did not influence the grain yield and root nodule per plant and N content of the nodule did differ significantly among P and Mo levels.

FERTILIZER-RESIDUE-effect on

-MAIZE -RESIDUE -IN CORPORATION,

YIELD-effect on

135. Hegde, B.R.; Havanagi,G.V. ; Reddy, N.Munikrishna ; Venugopal, N; Vishwanath, A.P. ; Satyanarayana, T. Studies on the incorporation of the Maize residue on soil properties and yield of Maize under rainfed conditions. Indian J.Agron. Sept- Nov 1982, 27(3), 254-8.

A study was conducted to evaluate the cumulative effect of maize residue on the red sandy clay soils of Banglore. In the experiment 4 tons of maize stalks per hectare/year were incorporated and beneficial effect on crop yields and soil properties were tested. The grain yield of maize increased from 18.8 q/ha in control to 23.5 q/ha in residue incorporated plots. Application of N at the rate of 75 kg per hectare produced significantly higher yield (32.5 q/ha) than 37.5 kg N (21.9 q/ha). The amount of potash increased due to incorporation of residue did not effect the yield.

SORGHUM-NITROGEN,SOURCES

136. Das, S.K.; Rao, A.C.S. Direct and residual effects of nitrogen sources dryland on Sorghum in black soil. Ann. Arid Zone. 1986, 25(1), 81-3.

Study indicated the effect of different sources of nitrogen to rainfed sorghum in black soil revealed different sources of nitrogen produced no significant difference in grain yield. Crop's yield was significantly low without nitrogen fertilization. Use of ures and Calcium ammonium nitrate gave same results. A mixture of urea and DAP also produced similar effect. The loss of available N through fixation was not significant for sorghum. Residual fertilityw was found to be unaffected by different sources of nitrogen.

EVALUATION

CROP BAJARA,MATURITY-PATTERN -Study of-HARYANA

137. Dayaram; Karwasra, S.P.S. Crop maturity Pattern in rainfed areas of Bawal tehsil, Haryana, Geogra Rev. India 1987, 49(2),19-26.

Study indicated that crop maturity of rabi sown area was considerably higher than Kharif sown area. Bajara, the dominant crop of Kharif season showed poor maturity level where as the maturity of Kharif pulses was better than other rainfed Kharif crops. In rabi season, taramira showed comparatively low crop maturity. The other crops

like gram, barley, mustard and gochani (mixed crops of gram and barley or mustard , were found successful, Hence, research needs to develop more suitable varieties of Bajara and taramira crops and improvement in the management practices is also required in order to raise crop maturity practices is also required in order to raise crop maturity index and to grain maximum output from the rainfed sown land.

FERTILIZERS TEST

CROP -MANAGEMENT, FERTO-INSECTICIDES,TECHNIQUES IMPROVED

138. Lal, S. How to increase production in rainfed upland areas. Indian Fmg. April 1988, 38(1),22-23.

Out of a total cultivated area of 180.36 million hectares 126.42 million hectares is rainfed. This large acreage of rainfed lands contributes only 45 percent of the total production. There are certain causes for lowering the yield in rainfed soils. Most of the crops are damaged by termites and other insect pests. Farmers apply insufficient amount of fertilizers due to economical backwardness and due to lack of moisture plants can not utilize high doses of fertilizers. Planting is not done on optimum dates

of sowing due to dependence on rains. Former do hurry in sowing without good lilth of seed bed, in order to utilize moisture. Crop get maturity before time resulting in total yield loss. Farmer face problems in plant protection, Non-availability of quality seeds, improved technology , indiquate credit facilities, inadequate training facilities.To increse the productiv, water conservation practices such as Contour bunding, digging of trenches, ploughing across the slope, use of organic manure, deep ploughings, use of mulch, recycling of runoff water and crop having combinations of short duration deep rooted, less foliage, resistance to drought should be selected for rainfed upland situations.

MAIZE VARIETIES,REGION-HIMALAYAN,NORTH-WEST

139. Kamta Prasad; Prem Singh. Response of promising rainfed maize (Zea mays) varieties to nitrogen application in north-western Himalayan region. Indian.J. of agric. sci. July 1990, 60(7), 475-7.

The field experiment was conducted at Almora during rainy season of 1988. The experiement comprising N rates (0,30,60 and 90 kg per ha) to 'D 822', 'Ageti 76', and 'P2'.

FORESTRY

TREE-CROPPING, SEMI-ARID-BUNDELKHAND

140. Patil, B.D. ; Gill, A.S. Continued tree cropping of Leucaena under dryland agroforestry situations. Leucalna News Letter 1980,1,12.

In Semi-arid areas of Bundelkhand uttar Pradesh India, Leucaena to Provide fodder and fuel was intercropped during the rainy season with cowpea, Echinochlo colomem, Sesame, Pigeoupea or groundnut.

GAMMARAYS

Influence of -IRPADIATION,VARIETY (Kalayan Sona)

141. Misra N.M.; Avijit Sen. Effect of gamma irradiation on wheat varieties under rainfed condition. Indian J. Agron. Sept.-Nov. 1982, 27(3), 231-4.

This experiment was conducted for two years in winter seasons of 1978-79 and 1979-80 at the Farm of the Institution of Agricultural Science,Banaras Hindu University to evaluate an optimum dose of gamma irradiation on different wheat varieties under rainfed conditions. The seeds of four varieties viz. Kalyan Sona, HD(M) 1553, UP 262 and Malaviya -12 were irradiated with five doses of radiations of 0,3,6,9 and 12 kr. The dose of irradiations 6 kr proved most effective for good yield of wheat grains. The variety Kalyan Sona gane highest yield.

GENETICS

GENOTYPE,INFLUENCE, SUNFLOWER-YIELD -effect on

142. Goyal, S.N.; Jivani, K.V. ; Modhavadia, M.M. Effect of genotypes and plant population on the yield of rainfed sunflower. Indian J. Agric. Sci. Dec 1985,55(12),733-4.

An experiment conducted in the rainy season of 1981 to 1983 in a split plot design with four replications. 'EC 68418' and modern varieties of Sunflower were grown at 6 densities by planting at a spacing of 60, 45 and 30 cm between rows and 20,15 and 10 cm within the rows. Yield of 'EC 68414' was higher than 3 years. A spacing of 60 x 20 cm gives 83,300 plants /ha resulted in significant higher yield.There was interaction of year X variety X inter-row spacings.

HYBRIDS-SORGHUM,AGRONOMIC-PRACTICES, FERTILIZATION

143. Srivastava, U.S.L.; Sardar Singh. Agronomic requirement of Sorghum genotypes under rainfed condition. Indian J.Agron. Dec- Feb.1980, 25(4) 624-6.

A comparative study was held on Sorghum genotypes (hybrids and Local T4) along with two nitrogen doses (75 and 150 kg /ha) at three levels of plant population (90,000,180,000 and 270, 000 plants / ha) for two seasons under rainfed conditions. A dose of 150 kg N/ha yield

more than a dose of 75 kg N/ha. A population of 180,000 plants per hectare was found optimum for both the genotypes . But in hybrid CSH-1 it could be 270, 000 plants / ha. The agronomic requirements of these two genotypes may differ from each.

OAT(FORAGE), SPECIES-KENT III-10- Performance of

144. Gill, A.S. ; Patil, B.D.; Yadav, C.L Performance of rainfed oat genotypes for forage and grain production. Indian J. Agron. Dec- Feb 1982,27(4),323-5.

Field trials were carried out at the Indian Grossland and Fodder Research Institute, Jhansi (U.P.) during rabi 1976-77 and 1977-78 under rainfed conditions. Testing of the oat genotypes for fodder and grain production was done under such conditions. Out of all the genotypes tested, kent-III -10 proved to be the best for fodder and grain.

PEARLMILLET, FERTILIZATION -NITROGEN

145. Gautam,R.C ; Bhaskar, S. ; Kaushik, S.K. Genotype and nitrogen interactions in pearlmillet under rainfed conditions. Indian J. Agron. Dec- Feb. 1984, 29(4) , 533-8.

The experiment comprised five genotypes. Among all the hybrids, Hybrids MBH 110 and BJ104 showed their superiority over other hybrids and composited. All these

hybrids responded to increaseing level of nitrogen and 60 kg N per hectare was found optimum to all the genotypes. MBH 110 and BJ 104 hybrids gave good results at 60 kg nitrogen per hectare.

SOLE/INTERCROPPING.

146. Bar, A.K.; Gautam,R.C.; Kaushik,S.K. Performance of perlmillet genotypes in sole and intercropping systems under rainfed conditions. Indian J.Agron. Mar-May 1988, 33(1) 52-5.

A 2- year study was conducted at I.A.R.I. New Delhi with 6 genotypes (BK- 560-230, MH-88, X-5, Wc-C-75, ICMS-7703 and RCB-2) of pearlmillet grown under 2 cropping systems (Sole cropping and intercropping), genotypes differed in yield and yield attributing characters. Intercropping of cowpea with cultivar RCB-2 gave good results. Hybrid MH-88 yielded significantly under both less and adequate rainfall conditions.

WHEAT, MORPHOLOGY/YIELD-effect on

147. Sharma, A.K. Morphological attributes towards yield in rainfed wheat (Triticum aestivum L.) J. Scient.Res. Bhopal 1985, 7(3) 151-3.

Twenty varieties of rainfed wheat were studied for phenotypic and genotypic correlations and path coefficient

analysis. Path-coefficient analysis showed that number of spikes had the highest positive direct effect on grain yield followed by 1000 grain weight, length of spike and days to maturity. Grain yield showed positive correlation with days to maturity , number of tillers, number of spikes, length of spike and straw yield per plant. It has been decided that improvement in grain yield of this crop is possible through selection for number of spikes and 1000 grain weight.

PHENOTYPIC,PULSE-CROP,SOYABEAN-DRYMATTER

148. Nigam, P.K.; Sharma, R.A.; Mishra, V.K.; Halkar, S.; Billore, S.D. Phenotypic stability of seed , drymatter and water use efficiency of Soyabeen (Glycine max) under rainfed condition. Indian J. of agric. Sci. Mar 1990, 60(3), 185-8.

Experiment indicated that environment played a significant role in altering the growth characters of soyabeen varieties. Singinificant genotype x environment (linear) interaction and pooled deviation suggested different performance of varieties to different environments predictable in nature. 'JS 71-5' soyabeen recorded the highest mean yield of 2256 kg /ha , followed by black -seeded 'JS 76-188' (1771 kg/ha) and 'Ankur' (1801 kg /ha). 'JS76-188' and 'Ankur' varieties gave higher yield and were stable under rainfed conditions.

PHYSIOLOGY, GEMPLASM, FERTILIZATION-VARIOUS DOSAGES

149. Singh , Y.P. ; Singh, U.S.P. ; Singh, A.K.; Krishna Mohan ; Ofha, S.N. Response of maize germplasms to varying levels on nitrogen under rainfed conditions. Indian J. Agron. Mar-May 1984, 29(1), 131-2.

The experiments were conducted to study the response of early and medium maturity of groups of maize germplasm to varying levels of nitrogen. Experiment comprised of three levels of nitrogen and five early maturing germ plasms and four medium maturing germplasms. The grain yield of maize increased significantly with increase in nitrogen level up to 90 kg/ha. The grain yield indicated that Diara ZFS3 significantly out yielded rest of the germplasm i.e. Diara Composite, D 765 and Local except MCU 508.

YIELD -Improvement of -TARAMIRA

150. Kumar, D.; Yadav I.S. Combining ability in taramiraunder rainfed conditions . Indian J. Agric Sci. April 1986, 56 (4) 229-33.

An analysis of the combining ability in the 10 inbreds of taramira revealed that both gca and Sea variances were significant for yield. The gca:Sca ratio indicated the preponderance of non-additive genetic variations for all the traits except primary branches and seed yield/ plant,

which showed additive variance. The 'TMC 13 p4' was the best combiner for number of branches / plant ; 'RTM2-1-6' for siliqua length ; 'Ldh comp 1-3 ' for seed yield, main shoot length and number of siliquae on main shoot. 'RTM 2-1-6' X 'Ldh comp. 1-3' and 'T 27P7-9' X 'TC 13P4' were the best combinations for yield and its important components.

INTERCROPPING

AGROECONOMICS, CROPS-OIL SEEDS -SAFFLOWER

151. Nikam, S.M.; Mahajan, M.S. ; Deokar, A.B. Improvement of monetary return of Coriander (Cariandrum sativum) through Safflower (Carthamus tinctorius) intercropping in dryland Indian J. Agric. Sci. Mar 1988, 58(3) 202-5.

The 2- year experiment indicated that 'local ' coriander (Coriandrum sativum linn) and ' Bhima' Safflower (Carthamus tinctorius) were grown in 2:1 ratio as an intercropping The combination gave extra monetary return of Rs.2,906 and Rs.378 per hectare over the main coriander and safflower respectively coupled with the highest net return of Rs. 3,579/ha. In all intercropping treatments, the land equivalent ratio and grain equivalent ratio were similar (1.25) when coriander was grown with safflower in 2:1 ratio.

BINARY, CROPS-PULSES, LENTIL/ CHICKPEA

152. Gangasaran ; Gajendra Giri, Intercropping of mustard with chickpea, lentil and barley in drylands Indian J.Agron. June- Aug. 1985, 30 (2), 244-50.

Experiments were conducted to assess the seed yield and competitive ability of associated crop species in binary compositions with mustard in different proportions (1 row of mustard alternated with 4,6 or 8 rows of chickpea, lentil or barley) under dryland conditions, the total economic produce mustard equivalent decreased but chickpea, lentil barley equivalent increased in all the systems. Higher yield advantage in 1:6 row ratio of mustard + chickpea or barley in dry season and in 1:8 row ratio of mustard + barley in wet season. Competitive ability of mustard was higher in all crop combinations and proportions.

COMPANION-CROPPING,COWPEA, DOUBLE/HYBRIDS-comparative study

153. Ved Singh ; Chauhan, P.S. Companion cropping in rainfed hybrid cotton. Indian J. Agron.Dec- Feb 1981, 26(4),450-1.

The experiment consisted of combinations of system of companian cropping (Pure cotton , cotton + cowpea, cotton + urd and cotton + mung) method of planting (Square 1 mx 1 m and rectangular 1.5 m x 0.66 m) in randomized block design

with 4 replications. Cowpea grown with cotton depressed the yield of seed cotton (about 50%) as compared with cotton + mung or urd. The cotton yield obtained with companion cropping of mung and urd were at par. Among companion crop, urd gave significantly more returns (Rs. 2638 q/ha) as compared to solid cotton (Rs.1137/ha).

CROPS,CEREAL-RICE, ORISSA-COASTAL

154. Rao, M.V. Jha, K.P. ; Moorthy, B.T.S. ; Mandal, B.K.; Padalia, C.R. Intercropping and crop substitution in rainfed uplands of coastal orissa. Indian Emg. May 1986, 36(2),33-4.

Research was conducted for four years at the CRRI, Cuttack to find out stable alternative or intercropping system to replace at least partially the system of monocropping rainfed rice. Field experiments were conducted on a typical upland randy loam soils of moderate fertility status and water table between 95-166 cm during the entire period of study. The Kharif season crops were sown bythe end of June. Entire quantity of P_2O_5 and K_2O was applied as basal dose and N was applied in three splits. Results showed that finger millet seems to be ideally suited as an alternate monsoon crop to rice. It has a variability index of 20 only as against 60 in case of

rice. Green gram is another crop with low variability index Ground nut and rice are crops with maximum variability Intercropping of greengram with finger millet considered by for the best practice. The next best intercrop combination is finger millet + ground nut but it showed high variability of groundnut and lower monetary return than that of pure crop of finger millet. For areas where it is difficult to wean farmers away from rice crop, the best strategy is to grow rice + greengram.

FIBERS,COTTON / BLACK GRAM, PESTS-effect of

155. Venkatesan, S. ; Balasubramanian, G. ; Sivaprakasam, N.; Narayanan, A.; Gopalan, M. Effect of intercropping of Pulses and Sunflower on the incidence of sucking pests of rainfed cotton. Madras agric. J. 1987,74(8-9), 364-8.

In this experiment incidence of sucking pests in cotton based intercropping system was studied in crop combination of cotton + Greengram, Cotton + black gram, Cotton + sunflower and cotton + lablab raised in paired rows and were compared with sole crops of cotton, black gram, green gram , cowpea, lablab, and sunflower. Aplid infestation was less in pure crops of green gram, blackgram and sunflower compared to crop combinations. Among the crop combinations tested, cotton + green gram recorded the highest gross income.

-FIBER/PULSES,COTTON (American)/MUNG

156. Nagre, K.T. Studies on the effects of intercropping on the growth, yield and economics of rainfed American Cotton Indian J. Agron. Dec- Feb. 1979, 24(4), 390-4.

The experiment was conducted at panjabrao krishi Vidhyapeeth, Akola, during Kharif seasons of 1973 and 1974 Emphasis was on intercropping of cotton with mung, Cowpea tur, sebamum and sunflower. Two years results indicated that intercropping of cotton with mung was profitable. Cotton + Mung intercropping system recorded 48.49 percent more total yield than pure crop of cotton. Intercropping of cotton with sunflower Sesamum and Arhar decreased the yield of cotton.

CROPPING SYSTEM

MILLETS-BAJARA (Hybrid /Cotton)

157. Koraddi, V.R. ; Kulkarni, M.V.; Kajjari, N.B. Overlapping cultivation of cotton in hybrid bajara under dryfarming conditions . Indian, Fmg. May 1970 , 20(2), 22-3.

A trial was conducted at the Medium Research Station Bijapur, Mysore, to study the possibility of growing cotton in standing crop of bajara under rainfed conditions. Trial consisting of 6 treatments was conducted in a Randomised Block Design with four replications for 3 years (1966-67 to 1968-69). Varieties used for study were HB 1 bajara and suyodhar cotton. Planting was done by dibbling bajara every

16 cm and cotton every 30 cm. within rows as per treatments. Fertilizers were applied only to bajara at the rate of 44.84 kg N + 22.42 kg P_2O_5 per hectare. The highest income of Rs. 791. per hectare was obtained in case of overlapping cultivation of hybrid bajara and cotton in 1:1(45 cm rows) proportion as against Rs. 518 and Rs.480 of entire bajara and entire cotton, respectively.

MILLETS/PULSES, PEARLMILLET/PIGEONPEA

158. Patel, J.S. ; Khistaria, M.K. ; Paida, V.J. ; Parmar , M.T.; patel J.C. Intercropping of pearmillet and pigeonpea in rainfed conditions. Indian J. Agron. Sept. Nov. 1985, 30(3), 283-6.

An experiment was conducted , to study the suitability and economics of intercropping of pearlmillet and pigeonpea with optimum plant population. The pearlmillet sown in paired sows with a distance of 49x 15 cm in between the two rows of pigeonpea (120 x 15cm) were more profitable combinations compared to pearlmillet alone with a net incremental cost Benefit Ratio of 1:3.68 . This pearlmillet + Pigeonpea with 100 per cent plant population of both the component s resulted in higher monetary returns of Rs. 1358/ha over sole crop of pearlmillet.

SORGHUM-EXPERIMENT

159. Singh, S.P.; Jha, D. Stability of Sorghum based intercropping systems under rainfed conditions . Indian J. Agron. Mar-May 1984, 29 (1), 101-6.

Experiments on intercropping with Sorghum has been conducted to study the comparision of stability of the system over seasons. The results indicating that the system of intercropping generated higher returns as compared to role cropping. The intercropping systems are more stable than role cropping, Intercropping provides greater strength to withstand adverse conditions.

OIL SEEDS

-CASTOR/GROUNDNUT- Study of

160. Al -Bakry, A.N.M.M.; Saran, G. Studies on castor based intercropping systems under dryland conditions. Indian J.Agrom Sept. -Nov 1985 , 30 (3), 393-5.

An experiment was conducted at the India Agricultural Research Institute, New Delhi on intercropping of groundnut (MH2) and green gram (PS 16) with castor (Aruna) under rainfed conditions. The treatments comprised pure crops and intercropping systems (1:1, 1:2, 1;3 row combinations of castor and green gram or ground nut in additive series. Castor received 40 kg each of N and P_2O_5, while green-gram and ground nut were fertilized with 20 kg N and 40kg P_2O_5/ha. seed yield of castor, grain yield of green gram, and pod yield of groundnut were significantly higher in their pure stands than intercropping systems.

GROUNDNUT,MICRO NUTRIENTS-WESTBENGAL-UPLAND

161. Mittra, B.N.; Rao, L.G. Groundnut cultivation in the rainfed uplands of West Bengal. Indian Emg. June 1988, 38(3),15-6.

Trials conducted at the Indian Institute of Technology Kharagpur in acidic Lateritic soil have shown that it can be successfully grown in west bengal unter rainfed upland sitation . Some of the promising varieties, 'TMV2','Kadiri' 3' 11-24'.'ICG 530', 'RRSHY5; 'ICGS-FDRS-4', 'CGC 4018', 'MH2', are recommended. The dwarf variety 'MH2' is expected to yield more at higher plant population . 'JL24', a spanish bunch, which matures in about 90 days, also performed well. Groundnut crop has relatively higher requirement of Ca,S. The sulphur can be met through Superphosphate and Lime application at the rate of 1,500 to 20,000 kg per hectare was found optimum to create favourable conditions. Application of 50 kg. P_2O_5, 6.0 kg Zinc and 0.6 kg boron per hectare without using Nitrogen was found beneficial. Intercropping of Groundnut Arhar ('JL 24' and 'ICPL-87') resulted in the highest yield.

TAMILNADU

162. Senthivel, T. ; Parmeswaran, P. ; Arumugam, M. ; Ramanathan T.An ideal intercropping system for rainfed groundnut (Arachis hypogea) in Tamilnadu, Indian J. Agric. Sci. July 1989, 59(7), 435-7.

This study was conducted to identify the profitable intercrops in rainfed groundnut (Arachis hypogea L.) at Trivandrum . The yield of 'TMV 12' bunch ground nut was found less when grown with 'Co25' Sorghum, 'CO7' pearl millet, 'KM 1' Cowpea, 'TMV1' blackgram and 'SA1' Aigeonpea compare with single groudnut crop. Groundnut showed least reduction (8.9%) in yield when grown with cowpea and more reduction (28.9% with Sorghum. Raising 1 row of blackgram for every 6 rows of ground nut gave significant income of Rs.27.53 per ha, which was Rs. 263/ha more than from the pure crop of ground nut.

OILSEEDS/ MAIZE, ROW-SPACING

163. Bhopal Singh ; Awasthi, O.P. Intercropping with legume and oil seed crops in maize at different spacings under rainfed conditions. Indian J. Agron. Dec-Feb. 1982, 27(4), 334-7.

An experiment was conducted, to study the effect of maize intercropped with the legume and oil seed crops at different spacings on total marketable produce and monetary returns. The grain production of maize increased when it was intercropped with blackgram, which gave gross returns of the order of Rs.6769 per ha against Rs.5147 per ha obtained from the solid stand of maize.

SAFFLOWER / CHICKPEA, PRODUCTION POTENTIAL

164. Nikam, S.M.; Tendulkar, A.V. ; Deokar, A.B. Production potential of sofflower- chickpea intercropping under rainfed conditions . Indian J. agric. sci. Mar 1987,57 (3), 151-6.

This 2 -year study the higher production and profit potentials of 'Chafa' chickpea and ' Bhima' Safflower intercropping over the traditional practices of sole chickpea When chickpea and safflower sown in 3:1 ratio, the system gave the significant monetary returns of Rs. 8,265 /ha . All the intercropping system showed land equivalent ratio and grain equivalent ratio were more than 1, being maximum (1.29) and (1.32) when chickpea was grown safflower in a 3:1 or 5:1 and 3:1 proportions respectively.

SOYABEAN /MAIZE, CLIMATIC CONDITIONS, NAGALAND

165. Dwivedi, R.M. ; Awasthi, R.P. Intercropping of Soyabeen in maize under rainfed agroclimatic conditions of Nagaland. Indian agric. 1986, 30 (4), 307-11.

An experiment was conducted to study the effect of maize intercropped with soyabeen on total productivity and net return. All intercropping system had higher total productivity and net returns than sole maize and soyabean. Maximum advantage was obtained from maize Soyabean 1:2 ratio followed by maize soyabeen 1:1 row ratio

and maize soyabeen 1:3 row ratio planting systems.

/PIGEONPEA, MADHYA PRADESH-NORTH

166. Foster, John H. Constraints to dryland double cropping in Northern Madhya Pradesh , Indian J. Agric. Eco.. April- June 1988, 43(2), 148-55.

This paper examines constraints to large-scale double cropping on drylands, which were identified in thevillage of Begumjung, Madhya Pradesh. The three-year field trial experience shows that dryland double cropping can increase both total /production and farm income. The Kharif land preparation and sowing period is typically only three weeks long. Yet in this period, heavy rains can cause waterlogging or delayed rains can cause dry soil. Both will delay sowing while the farmers wait for favourable soil conditions. The soyabeen and pigeonpea intercrop involves only soyabeen harvesting in september. Sequential cropping on the other hand, requires harvesting and threshing plus seedbed preparation and rabi planting in the short window of time between Kharif crop maturity and soil too dry for planting. In the study year, the 25 farmers used 48 percent of their rabi crop land for wheat and wheat chickpea mixtures. Sole chickpeas and lentils occupied 42 percent of rabi crop land suggest practices should be followed to overcome constraints.

CROPS PULSES

CLUSTERBEAN /MUNGBEAN SEMI-ARID

167. Singh , B.P. ; Rana , V.S. ; Yadav , B.S. Intercropping of mungbean and clusterbean in pearlmillet and urdbean in rainfed conditions, Pulse crops News letter. 1981, 1(4),35-6.

In trial under semi-arid tropical conditions, intercropping of vigna radiata or Cyamopsis tetragonoloba in between the rows of pearlmillet had no adverse effect on its grain yield and gave additional seed yields of 100-163 and 564-895 kg per hectare respectively. Cultivar tetragonoloba alone and with an intercrop of V. mungo gave similar seed yields, but intercropping covered the risk of the crop failure.

MILLETS,PIGEONPEA/SORGHUM

168. Gupta, M.L. : Sharma, O.L. Studies on Sorghum /pigeonpea intercropping under rainfed conditions. Indian J. Agron. June Aug 1984, 29 (2),213-7.

The experiment was conducted during Kharif season of 1977, 1978 and 1979 to study the intercropping of pigeonpea with hybrid Sorghum. The yield of sorghum does not affected when grown in paired rows of 30+60 cm. The mean yield of sorghum was 23.12 q/ha when it was planted uniformaly at 45 cm and 23.61 q/ha in pair (30+60 cm). Mean LER (1.26) was the highest when sorghum was grown in paired rows at 30 + 60 cm and intercropped with onerow of pigeonpea.

MUNGBEAN/GUAR

169. Singh , J.P. ; Singh B.P. Intercropping of mungbean and guar in castor under dryland condition. Indian J.Agron. June -Aug. 1988, 33(2), 177-80.

A field experiment was conducted on aridisols in dryland four three years (1983-84, 1984-85 and 1985-86) at Dryfarming Research centre of Haryana Agricultural University, Bawal. Experiment consisted of intercropping of mungbean and guar in planting systems of castor. Intercropping of one row of mungbean and 2 rows of guar in castor in 30/120 cm gave maximum net returns of Rs.7337 and Rs. 7330 per ha. Greater water use efficiency values were recorded where guar and mungbean intercrops were taken in castor.

PIGEONPEA /COMPATIBLE

170. Patel , J.R. ; Parmar, M.T. Studies on intercropping of compatible crops with pigeonpea under rainfed conditions. Indian J. Agron. Sept. -Nov. 1988, 33(3), 253-6.

Field investigations were conducted to identify relative compatibility of different crops with pigeonpea for maximizing production and income per unit area under rainfed conditions. Under the experiment pigeonpea, pearlmillet, Sorghum, groundnut and seasame each as pure as well as intercropped with pigeonpea were tested. The results indicated that each crop as intercrop gave higher results as compare to

pure crop. Out of all the intercropping systems, pigeonpea + groundnut gave the highest returns followed by pigeonpea + pearlmillet.

CROPPING PATTERNS,REGION-UDAIPUR

171. Srivastava, S.P.; Singh ,A.P. Intercropping under dryland conditions of Udaipur region. Indian Fmg. Jan 1980, 29(10),16

Arhar is promising intercrop with sorghum under dryland conditions in Udaipur region. Experiment was conducted during Kharif season of 1973-74 and 1974-75 . In both the years the base crop was sorghum (CSH-1) and intercrops were moong, urd, Arhar, and grounnut. In the second year soyabeen was added as the fifth crop in above experiment Fertilization in the first year was done at the rate of 60 kg N per hectare and 40kg P_2O_5 per hectare and in second year 40 kg N/ha and 20 kg P_2O_5/ha. The highest net income was obtained from the mixture of sorghum + Arhar in both the years.

CROPPING SYSTEM, CULTIVATION,LOW-RAINFALL-UTTARPRADESH-EASTERN

172. Singh, J.P. ; Yashwant Singh. Increasing and stablishing Crop production from drylands in eastern uttar pradesh. Indian Fmg. Aug. 1988, 38(5), 11-4.

There were certain constraints till mid sixties. They are non-availability of short duration varieties for the dryland areas, growing of long duration crop in rabi on the moisture conserved lands during rainy season and limited o fertilizer use. The cropping system of the drylands can be prepared on the basis of pattern of natural precipitation, soil type, and availability of suitable crop varieties. This could be achieved through mixed or intercropping. Combinations may be bajara + blackgram, Arhar + blackgram and Arhar+ greengram. egume base cropping system such as blackgram barley, blackgram- wheat, nitrogen economy is possible.

MIXED CROPPING,WHEAT/CHICKPEA, YIELD /WATER-USE- effect on

173. Narindar Singh ; Nathu Singh; Ranjodh Singh; Tejinder Singh, Mukhtar Singh, Yield and water use of rainfed wheat + chickpea mixture as affected by N and Papplications in clay loan, sandy- loam, and loamy sand soils. Indian J. agric sci. Jan 1985, 55(1), 13-7.

Field experiment conducted during 1977-79, indicated that rainfed wheat (Triticum aestiuum Linn.) + Chickpea (Cicer arietinum Linn.) mixture responded to N application up to 60 kg /ha in clay loam soils. Sandy-loam and loamy sand soils gave response N application of 20 to 60 kg /ha depending up on the amount and distribution of rainfall in different seasons. In the soils having own P content upto 12.2 kg P/ha were required to be incorporated the 8.7 kg P/ha for the

same crop mixture. The application of N and P increased the total water use by this crop mixture.

MULTIPLE, EFFICIENCY -RELATIVE,PIGEONPEA

174. Tomar,S.S.; Sharma, R.K.; Namdeo, K.N. Relative efficiency of multi intercrop system in Pigeonpea under rainfed condition Indian J. Agron. Dec. Feb. 1984, 29(4), 475-9.

In the experiment conducted, four crops (Urd, Soyabeen, ground mut moong and jowar) were used as intercrops in between pigeonpea in 1:1,1:2, and 2:2 planting ratios. Results showed that intercropping in pigeonpea with soyabeen and urd (black gram)gave good return the single crop of pigeonpea. The crop rotation of pigeonpea + soyabeen (1:2 ratio) was most profitable with net income of Rs. 4,835/ha followed by pigeonpea + Soyabeen and pigeonpea and urd.

PARALIEL, CROPS-WHEAT /CHICKPEA,VARIETIES-RAINFED

175. Yadav, N.D. ; Yadav, D.S. Studies on production potential of parallel multiple cropping with chickpea under rainfed conditions. Indian J. Agron.Sept Nov 1985, 30(3),364-9.

Discussed, the suitable parallel crops and efficient method of chickpea sowing. Study revealed that the highest grain and straw yield of chickpea was obtained with parallel cropping with wheat. All the paralel crops performed the best under the system with one row of parallel crop in between

two normal sown rows of chickpea. The chickpea+ barley combination gave the highest yield equivalent to chickpea. Sowing in alternate rows followed by two paired rows of chickpea and one row of chickpea and one row of parallel crops (2:1) proved an efficient system in respect of total chickpea yield equivalent.

PLANTING PATTERN/NITROGEN ECONOMY -Study of-COTTON

176. Giri, A.N.; Upadhyay, U.C. Studies on Planting pattern, intercropping and nitrogen economy of H-4 cotton under rainfed conditions. Indian J. Agron Mar-May 1980,25(1),71-6.

Experiments were carried out on the planting pattern, inter cropping and nitrogen economy to H-4 cotton under rainfed conditions on medium black soils during 1975-76 and 1976-77. Results indicated that mung and ground nut intercropping was beneficial as the yields of seed cotton obtained in these treatments at per with the yield obtained in cotton solid planting and paired row planting. The yield of seed cotton was influenced significantly due to nitrogen levels during both the years. Every higher level of nitrogen had recorded significantly higher monetary returns over its lower level during both the years. The recommended dose of nitrogen of both the crops resulted in significantly higher monetary returns /ha and was found economical.

SOLE/INTERCROPS, PRODUCTIVITY- Comparative Study

177. Venkateswarlu, S.; Subramanian, V. Bala. Productivity of Some rainfed crops in sole and intercrop systems. Indian J.of agric. sci. Feb. 1990, 60(2), 106-9.

This study was to compare the productivity of 'CSH6' sorghum + 'HY2' pigeonpea, 'HY2' pigeonpea + '79'blackgram and 'Aruna ' Castor + 'Pusa Navabahar' clusterbean intercrop systems. Cluster bean being a sensitive crop reduced the yield by 50% due to intercropping. The yield of pigeonpea with sorghum was only 56% of the sale crop yield, and with blackgram, the yield was as much as 88% of the sole crop production. The reduction in intercrop yield wad due to decrease in seed or pod number per unit area and it is because of adverse effect of intercropping began before flowering stage.

MANAGEMENT-CROPS

ECONOMETRY,RICE-BIHAR-DRYLAND

178. Singh, R.P. ; Thomas, Saji ; Naresh Chandra. Factor demand, output supply and constraints to dryland rice production in Ranchi district of Bihar. Agrl. Situ in India July 1989, XLIV (4) , 265-9.

The introduction of the modern dryland technology has increased the demand for farm inputs as well as supply of outputs. Among the various inputs, the share of human labour

was maximum, followed by bullock labour, manures & fertilizers and seed. The factor demand analysis points out that agricultural product prices, wage rate and fertilizer price are the most important variables in achieving the goal. The product prices should be enough to induce an output response and cancel the negative factor demand effect resulting from own and complementary input prices.

FERTILIZERS-Comparative study-DRYLAND

179. Umrani, N.K. ; Narkhede, P.L. ; Patil, C.B. Efficient use of fertilizers in drylands. Indian Fmg. April 1984, 34(1), 35-6.

Trials were conducted on farmer's fields through Integrated dryland Agricultural project by the Scientists at the Dry farming Research Station, Solapur. Comparative performance of 'CSH8R' and CSV8R' with check M 35-1 variety of Rabi Sorghum was studied on farmers fields at 50 kg N/ha latest varieties responded significantly in comparision to 'M35-1'. Because of non-availability of rains during post-sowing period, seeding is done by early September. Early seeding gives nearly 3 times the response to normal seeding time. Fertilizer is made to go depper by using fertilizer seed drill. This increases fertilizer use efficiency due to placement of fertilizers. Management implies proper spacing, adequate plant density, and timely weed control By these practices the resources like fertilizer are better utilized resulting in higher crop production.

PHOSPHORUS-GROUNDNUT,VARIETIES-DRYLAND

180. Masood Ali; Rawat, C.R. Response of groundnut varieties to phosphate application under dryland conditions. Indian J. Agron. Dec- Feb. 1982, 27(4) , 465-7.

Field experiments were conducted during Kharif seasons of 1978-80 at central Research Farm, Indian Gross land Fodder Research Institute , Jhansi under dryland conditions. Treatments comprised combinations of four varieties (Exatic 1-1, SB-11, Jyoti and Local-T 27 and four levels of phosphate (0, 25,50 and 75 kg P_2O_5/ha). Phosphate application through band placement at sowing along with basal application of 20 kg N/ha was done. Pod yield showed that SB-11 gave highest yield (9.63 q /ha) followed by Exotic 1-1 SB-11 was significantly superior to local varieties. The mean pod yield at 25,50 and 75 kg P_2O_5 per hectare was 8.16 q, 9.28 q, 9.69 q and 9.33 per hectare, respectively. However, the response was limited up to 25 kg P_2O_5/ha.

GENERAL-THRESHING-DRYLAND

181. Sharma, K.D. ; Devnani, R.S. Threshing studies on some dryland crops. Ann.Arid Zone. 1980, 19(1&2), 139-45.

Study determined the threshing parameters like seed rate, grain output, threshing efficiency, energy consumption,and visible and internal seed damage for cowpea, sunflower and

mustard at different cylinder tip speeds and concane clearences. Threshing efficiency increased with the increase in cylinder tip. Seed rate and grain output increased with cylinder tip and concave clearances. Visible and internal seed damages increased with increase in cylinder tip and decrease in clearance. Recommended cylinder tip speeds and concave clearances for cowpea, sunflower and mustard were 496.0 mpm and 12.0 mm and 454.5 mpm and 4.0 mm when used for pulse and oil extraction ; 288.5 mpm and 12.0 mm and 288.5 mpm and 12.0 mm for seed purpose respectively.

MANAGEMENT-FINANCE -DRYFARMING

182. Patel, R.K.; Gangwar, A.C. Acquisition and credit requirements for crop production in dry farming areas of Haryana. Indian Coop. Rev. Oct. 1982, 20(2) , 161-67.

The cultivators of rainfed areas are very poor as compare to their counter part in irrigated areas. Linear programming technique was used to develop the optimum farm plans and to know credit requirements of the farmers. Under this plan,the credit needs for crop production was found to be Rs.895, Rs.694, and Rs.864 per hectare, respectively on small, medium and large farms. Primary Agricultural credit societies (PACS) were found to be the main source of credit. Inspite of the fact, the farmers of the area were facing many problems in

borrowing from these societies. These problems can be minimized by proper education and training of the farmers and strict supervision by supervisory staff.

MINOR-MILLETS,MEASUREMENT-YIELD-DRYLAND

183. Rajashekara, B.G.; Gopal Krishna Hebbar B. Yield gap analysis in dryland ragi (Eleusine coracona (L.) Gaeren). Ann. Arid Zone. 1985, 24(2), 124-30.

This study was conducted to evaluate the magnitude of yield gaps in dryland ragi and contribution of technological, physical, economical factors which are concerned with yield gaps. Income level of ragi crop could be improved by adopting new varieties, sufficient amount of fertilizers and package management practices. Income level of Rs. 3,543 with ragi yield of 7.68 q/ha alongwith intercropping could be improved to Rs. 3,543 through production of ragi 15 q per hectare by adopting above three practices. Use of improved variety along with recommended amount of fertilizer resulted 64% of the gap in yield and 36% of the yield gap was contributed by package management practices.

MANAGEMENT TECHNOLOGY

SEED-PRODUCTION, CLUSTERBEAN-DRYLAND

184. Reddy, T. Yellamanda ; Ramkumar Reddy, K ; Rajan, M.S.Soundura; Reddi, G.H.Sankara. Production Potential of seed clusterbean genotypes as sequence crop in dryland. Indian J. Agron. Mar-May (1981), 26(1),89-90.

A trial was conducted during rabi 1978 to know the seed production potential and economics of clusterbean as a sequence crop in dryland. Experiment consisted five genotypes in a randomised block design, replicated four times. The crop was sown in November after the harvesting of rainfed groundnut with using 30 N, 18 p and 17 k kg/ha. Result indicated that maximum yield of 1,590 kg/ha was of genotype FS 227.

TREATMENT, BARLEY-RAINEED

185. Singh,A.I.; Chatterjee, B.N. Barley production under rainfed conditions with pre-treated seeds. Indian J. Agron.Dec. Feb 1980, 26(4), 600- 607.

Study indicated the effects of soaking seeds in water and other salt solutions and then drying to the original weithts of the seeds.The study revealed that seed treatments with Na_2HPO_4 $12H_2O$ solution (358 ppm for 6 hr) and water (24 hr) increased grain yield by 37 and 24 per cent respectively. The increase in yield was mainly due to higher number of ears/ unit of area, larger number of grains /ear and the havier grains than the yield recieved from untreated seeds.

STABILITY-DRYFARMING

186. Swaminathan, M.S.; Rao,N.G.P. Increasing and Stablishing agricultural production Under dry farming. Indian Fmg. April 1970 , 20(1), 5-7.

This paper describes the development of suitable varieties of crops, cropping patterns and the necessary package of practices for rainfed areas. The 'CSH1' of Sorghum and 'HB3' of hybrid bajara has become very popular under extreme moisture stress. Soil and moisture conservation practices should be followed . New varieties have demonstrated 3-4 tonnes more per kg of nitrogen in comparison with locals. Placement of fertilizer, in place of broadcast, in relation to seed increased the response manifold. Production of almost crops can be achieved around 2000 Kg grain per hectare as against the existing 200-500 kg /ha on the rainfed lands by applying alternate crop and cropping system and other package of practices.

TECHNOLOGY, AGROECONOMICS, COST/BENEFITS,IRRIGATION DRYFARMING.

187. Tej Bahadur; Parthasarathy, P.B. ; Srinivasulu reddy, K. Resource use efficiency in dry farming. Agrl. Situ in India April 1988, X LIII (1), 29-32.

India (a developing country) has made great strides in developing irrigation resources to increase the Agricultural production. Indian council of Agricultural Researches

has sponsored a pilot project for the integrated dryland agriculture development. To estimate resource use efficiency cobb- Douglas functional model has been used after observing scatter diagram. Marginal value product (MVP) to factor cost ratio is the measure of resource use efficiency. Equality of MVP to factor cost ratio indicates the optimum resource use efficiency of of a particular input. The MVP to factor cost ratio for cattle labour on small farms was more than one indicating too little use of this resource. By increasing the use of this resource, profits can be increased on small farms.

TRAINING Impact of , CROP -OIL SEEDS,GROUNDNUT ANDHRA PRADESH -RAINFED

188. Nagi reddy, K; Rathnakumari, S. Impact of farmers trainingon knowledge and adoption of improved practices of rainfed groundnut in Andhra Pradesh. Andhra agri. J. 1986 ,33(4), 367-9.

Significant difference was observed in the levesls of knowledge of improved cultivars / practices of rainfed ground nut in case of trained and untrained farmers. Likewise the trained and untrained farmers exhibited significant difference in the adoption of new technologies in rainfed groundnut.

TRENDS, GENERAL, RESEARCH REPORT-DRYLAND FARMING

189. Jodh, N.S. Research and technology for dryland farming in India: Some issues for the future strategy. Indian J.Agric.Eco. 1986, 41(3) , 234-47.

Since the early 1970s, some increase in research resource allocation to dry land agriculture has taken place. There were have established an agenda for future R and D for dryland agriculture. High priority should be attached to (i) increasing the productivity and competitiveness of dryland crops;(ii)Strengthening the range of multiple options ;(iii) conserving and rehabilitating degraded lands; and (iv) generating technology options for incorporation into new development programmes. Agricultural research and technology are grouped in two categories (i) resource- centered research/ technology, and (iii) crop or seed centred research / technology .The former in the case of dryland agriculture includes soil and moisture conservation practices and their efficient use. The latter covers the work related to crop improved through breeding , selection, and adaptions, etc. For raising income and not just crop production ;(i) high yielding varieties should be sown, (ii) resources should be provided to the farmers to encourage adoption of new technology (iii) high value food crops such as oilseeds and pulses should be chosen.

PERFORMANCE

CROPS-BARLEY VARIETIES,N. LEVELS -BIHAR-RAINFED

190. Varshney, J.G. Performance of different varieties of barley to N levels under rainfed conditions of North Bihar. Indian J. Agron. June-Aug 1979, 24(2),235-6.

The experiment consisted of 4 varieties (vijay, K-125,DL-3 and Ratna) and 4 levels of nitrogen (0,20,40 and 60 kg/ha) in a split plot design with 4 replications. All the treatments received a basal dressing of 20 kg each of P_2O_5 and K_2O. The variety 'Ratna' out yielded the other varieties. The 40 kg N/ha was found to be the best. The grain :Straw ratio was also found maximum in 40 kg N per hectare level. The grain :straw ratio was lowest in variety DL-3 while in others it was almost at par.

CASTOR,HYBRID/VARIETIES, -TELENGANA-RAINFED

191. Hanumantha rao,C ; Vittal, K.P.R; Rao, U.M.B. ; Sanghi, N.K.; Vijaylakshmi, K. Performance of castor hybrid and variety under rainfed conditions of Telengana. Indian J.agric. Sci. Dec. 1986, 56(12),828-32.

A 3- year field experiment conducted on red soils of Telengana showed that hybrid 'GAUCH' 1' of castor (Ricinus Communis Linn.) is more adaptable to drought and gave more yield than 'Aruna '. Primar and secondary spikes gave more

yield under low rainfall conditions. Testiary spikes of 'GAUCHI' which always matured under low aridity, added significantly more seed yield. The root system in the hybrid was not affected by the compactness of Soil, while that of the variety was constrained. Due to greater root penetration and spread of root system, consistent higher yield in subnormal and normal rainfall 'GAUCHI' was recommended for the red soils of Telengana.

-GREENGRAM/COWPEA, VARIETIES,PERFORMANCE-RAJASTHAN-WESTERN-DRYLAND

192. Prasad, M.V.R.; Chaudhary, B.S. Studies on the performance of some varieties of pulse crops on drylands of western Rajasthan. Arid Zone. 1978 ,17(2) ,222-8.

Study indicated that a number of varieties of greengram and cowpeas on drylands showed superiority of early maturity varieties with compact and dense plant type. 58 of moong, FS 68 and K11 of cowpeas produced higher number of pods per plant.

SOYABEAN, VARIETIES-Comparative study -RAINFED

193. Rajput, R.P.; Sastry, P.S.N. Comparative performance of three varieties of rainfed Soyabeen in a monsoon climate. Indian J.Pl. Sci. 1987, 5(1),10-16.

Discussed that dry matter production and crop growth rate patterns of three varieties of Soyabeen (UPSM-19, Bragg, and Ankur) raised under rainfed conditions in a monsoon climate in relation to phenological stages. The crop growth rates are found to be relatively higher during the flowering to pod development stage. Variety Bragg recorded the highest grain yield.

PEST-CONTROL -MANAGEMENT

INSECTICIDES-CROP-CEREAL,WHEAT -RAINFED

194. Randhawa ,A.S. Technology for rainfed wheat, Indian Fmg. Sept. 1986, 36(6) , 3-6.

Farmers can get remarkable yield of wheat by conserving moisture, dressing seeds, spraying pesticides and by applying fertilizers. For conservation of soil moisture, bunding of fields before the onset of monsoon rains, checking of growth of weeds and mulching with suitable material are very essential To minimize the damage due to various pests 25 kg. B.H.C. 10 per cent,25 kg Aldrin 5 percent should be uniformly broadcast in one hectare of land. Damage due to foot -rot and root- rot can be minimized by the seed dressing with 2.5 g cessan or captan per kg. of wheat seed. In rainfed wheat drilling of 40 kg N and 20 kg. P_2O_5 per hectare 10 cm deep at the time of last ploughing is benificial. Some of the recommended varieties for rainfed areas are 'C 306', 'Sonalika', VL 421; 'WL410', WL2265; 'N59'etc. to ensure proper germination, farmers start sowing dryland wheat from

mid October to last week of October.

PEST-CONTROL, INSECTS, CROPS-FIBER-COTTON-RAINFED

195. Patel, V.N.; Bhalani, P.A. Evaluation of insecticidal spray schedule against the major pests of cotton (GAU-Cot 10) under rainfed conditions. Pesticides, Bombay, 1988,22(8), 31-3.36.

Four insecticidal spray schedules using 4 different insecticides applied at different intervals were evaluated insecticidal apary schedule included 4 different sprays of insecticides namely dimethoate , endosulphan, carbaryl and endosulphan 0.07%, 45,60, 75, and 90 days after sowing Spray schedule having one more spray with monocrotophas 0.05% 105 days after sowing were found significantly Superior over rest of the treatments against the major pests of cotton under rainfed conditions.

GENERAL-DRYLAND

196. Pal, S.K. A note of leaf weevil (Cystozemia cognata Marshall (curculionidal : Coleoptera) infesting Kharif Crops in dryland farming. Ann.Arid Zone. 1972 ,11(1&2), 132.

Experiment conducted at the central Research Farm of CAZRI during July-August of 1969. It indicated that leaf weevil was noticed doing considerable damage to moong (Phaseolus auseus). Except moong it attacked on sunflower

(Helianthus annus), Cotton (Gassypium spp.) , Cowpea (Vigna catjang), Soyabean (Glycine max) and til (Sesamum indicum).Study revealed that these plants are now new hosts of this pest.

PHYSIOLOGY

CROP-FORAGE,COWPEAS-DRYLAND

197. Jatasra, D.S.; Dahiya, B.N. Relative importance of Forage yield components in cowpeas under dryland conditions.Indian J. Agric . Res. Jan.-Mar. 1988, 22(1), 1-5.

Forage yield was significantly correlated with leaf weight, stem weight, plant height, and branch number stem weight and leaf weight were positively related with themselves and also with plant height, leaf length and width of the leaf. Stem weight and leaf weight were the most important components of both green fodder and dry matter yield, as they had highest positive direct effects. The forage yield of cowpea varieties under rainfed conditions decreased with increase in the number of leaf per plant.

WHEAT,YIELD-ASSOCIATION-RAINFED

198. Sheoran, I.S.; Luthra, O.P. ; Kuhad, M.S. Association of Physiological and biochemical characters with the yield of rainfed wheat. Indian J. agric. Sci. Feb.1986, 56(2),71-4.

Study indicated various significant genotypic differences in 29 varieties of rainfed bread wheat. Differences may be in spike length, plant height, grains/ spike, 1000-grain weight, canopy temperature , ralling index, flag leaf area, osmotic potential , proline content and nitrate reductase activity. The yield was strongly and possitively correlated with spike length, plant height grains /spike, flag leaf area and negatively related with canopy temperature. According to path-coefficient analysis the selection of rainfed wheat may be depend on 1000-grain weight , grains/ spike and canopy temperature.

PLANS

ACTION, DRYLAND FARMING

199. Usha Patel. Dryland farming in need of action plan. Financial Express. April 19,1986, 13(52),4.

The government has recognised that development of dryland farming was most essential for ensuring national food security, narrowing down regional imbalances and creating rural employment. Government took two pronged strategy (i) Extensive approach covering all dry land areas (ii)the intensive approach where under in selected blocks, micro-watersheds of 2000 to 3000 hectares. The strategy for the implementation of the dryland farming programme concentrated

first on an intensive approach, it takes care of soil and water management, agroforestry , posture development animal husbandry, horticulture etc. Secondly it concentrated on extensive approach which takes care of distribution of equipment and propagating known technologies of dryland farming. International crop Research Institute for semi-Asia Tropics (ICRISAT) has perfected viable technology and demonstrated which needs to be appreciated for adoption. Banks provided loan facilities either in the form of short term, medium and long terms. For developing dryland farming through micro-watersheds projects, it is now essential to prepare result oriented action plan. Certain steps has to be followed for success.

PLANT GROWTH

VARIETIES, IMPROVEMENTS-DRYLAND

200. Prasad, M.V.R. Somec considerations on plant types for dry land agriculture Ann. Arid.Zone 1973,12 (3&4),125-34.

A desired conceputual model or 'ideotype' of crop plants for rainfed agriculture have to be designed so as to achieve a desired and balanced combination of resistance to soil and atmospheric drought on one hand andthe plant productivity parameters on the other. It is necessary to incorporate a suitable maturity pattern. It will enable the crop to overcome the long spells of drought at critical growth and developmental stage. Mixed cropping should be adopted in order to make an insurance of main crop against the failure of crop. Components of competitive ability and

complimentarity should be considered at the time of mixed cropping . To overcome the undesirable character association in this regard, the plant breeding tool such as mutation, disruptive selection, random mating and heterosis breeding would be useful.

PROJECTS

DROUGHT-TOLERENT, CROP-PRODUCTION , CROPS-PULSES-LENTIL-DRYLAND FARMING

201. Lal, S.Lentil an ideal pulse crop for dryland farming. Indian Fmg. July -1985, 35(4),23-4.

The All India co-ordinated pulse Improvement project and the ICAR Institutes have investigated many improved and high yielding varieties of lintil. They can give as much as 15-20 quintals yield per hectare by following prescribed package of practices. Among the four important pulses (gram, peas, Lentil and Lathyrus), the Lathyrus is most drough tolerant and Lentil stands next. The recommended varieties for specific situations are 'T-36', Pant L 406', Pant L 209',Pant L639', 'BR 25', B-77', S-256 ; 11PL (v'pasa); V.L. Masur ; LSW1,2,3 and others. 2-3 ploughings followed by planking are enough in order to check loss of moisture. Sowing should be done in rows spaced 22.5 to 30 cm apart. For getting better be applied . Apart from this other plant protection measures should be aopted and harvesting should be done at proper time when the leaves become yellow.

RESEARCH

CASE-STUDY, AHMED NAGAR -DRYLAND FARMING

202. Dangat, S.B.; Dhongade, M.P. Dryland farming : A case study of Ahmed-nagar district. Economic Times July 30,1984,11(126),5.

The earlier research efforts on dryland led to the formulation of a series of useful dryforming practices such as "Bombay dry farming practices" and "Madras dryforming practices". Their basic ingradient was soil and moisture conservation. The Ahmednagar district of Maharashtra is a drought prone district- in the country. The annual rainfall ranges from 500-700 mm. It was noticed that cereals occupied 70.47 percent of the gross cropped area. The area under pulses was only 8.32 percent to the gross cropped area. Sugarcane occupied 4.56 percent of the gross cropped area. Rabi Jowar and bajara got priority in the cropping scheme. The yields are influenced by variables like :(1) an unpredictable or random manner (2)Systematic or predictable fashion. Only a marginal increase in the per hectare yields was noticed in main crops of district namely. Bajara and rabi Jowar. This review of situation suggests that efforts need to be made to increase the productivity of bajara and rabi Jowar in the district.

CROP-PEARLMILLET, INTERCULTURE -effect of-RAINFED

203.Malik, A.S. ; Faroda, A.S. ; Jagdev Singh. Effect of intercultur on performance of pearlmillet under rainfed conditions. Ann. Arid Zone. 1986, 25(3), 239-41.

Study indicated the six interculture treatments viz. traditional hand hoe, wheel hand hoe, country plough, and plough drawn by tractor, for weed control in rainfed pearl millet crop. uses of wheel hand hoe and country plough were found effective in weed control and thus enhanced the yield of pearlmillet.

CROP-PRODUCTION, CROP-CEREAL -WHEAT -VARIETY(Kalyansona/ K 852)- TRIAL-RAINFED

204.Misra, N.M. ; Haripal ; Dwivedi, D.P. performance of wheat varieties under rainfed conditions. Indian J. Agron.Dec-Feb. 1980, 25(4), 577-80 .

A field trial was conducted during rabi season of 1973-74 and 1974-75 to test the performance of nine wheat varieties viz. K65, K68, S 308, WG 377, K852, Kalyansona Sharbatisonara, Moti and UP 310, under rainfed conditions. In the present study the higher grain yield was of Kalyansona, followed by K 852 and WG 377.

-MINOR MILLETS,VARIETIES, Mandua/Ragi (RAU-21), VALLEY-DOON

205.Tyagi, P.C. ; Koranne, K.D. Ragi varieties for rainfed areas of Doon Valley. Indian Fmg. June 1984, 34(3),17-8

Ragi (Elensine coracana), Known as Mandua in Uttar Pradesh, is widely cultivated in the hilly regions. It is grown in Kharif as a rainfed crop and people use it as a staple food. Varietal screening work was done at the Division of Rainfed Agriculture and water Management of the Central soil and water conservation Research and Training Institute, Dehradun from 1980 to 1982. As a result varieties 'RAU-2', 'HR-374', 'TNAU-169', 'RAU-7 ' and 'TNAU-167' have been identified. The early maturing varieties not only escape the drought but also leave sufficient residual moisture for succeeding rabi crops. The above mentioned varieties have yielded respectively 84.21,70.13,55.48, 35.14 and 31.58 percent higher over the local ragi varieties. 'RAU-2' and 'RAU-7' appears to be a suitable proposition for the rainfed areas of Doon valley.

SETARIA,VARIETY (Si A. 326)-ANDHRA PRADESH-RAINFED

206.Rao, Y. Gurunandha. 'SIA326' A high yielding variety of Setaria for rainfed conditions. Indian Fmg. July 1985,35(4), 9-11.

Experiments conducted at the Regional Agricultural Research Station, Nandyal, Andhra Pradesh has investigated a high yielding and early maturing variety of Setaria name 'SiA-326'. Its local name is 'Korra' and is an important staple food for poor and tribals of Andhra Pradesh. Due to its prolonged drought tolerance, it was preferred in rainfed areas next to Sorghum. Records of the trials indicated the yields of grain and straw upto 2,420 kg and 3,070 kg per hectare respectively which comes to 130 per cent and 90 percent increase in grain and straw yield over 'Arjuna ' variety. Prescribed agronomic practices are to be followed for achieving higher yield of Setaria.

INNOCULATION- AGROCHEMICALS ,CROP-BARLEY,YIELD - effect on -RAINFED

207. Solanki, N.S.; Singh, R.P. ; Chauhan, R.S. Effect of nitrogen agro-chemicals and azotopactor inoculation with and without FYM on yield and quality of rainfed barley. Indian J.Agric. Res. Jan-Mar 1987,21(2), 83-7.

Experiments were carried out during rabi seasons of 1976-77 and 1977-78 to study the effect of nitrogen levels, agro-chemicals and Azolobactor inoculation with and without FYM manuring on the yield and quality of rainfed barley. Application of nitrogen upto 60 kg/ha increased the production

of barley. FYM @ 10 tonnes per hectare + Azotobactor inoculation increased the barley yield. Among the Agro- chemicals application of Kaolin increased the yield due to maintenance of higher turgidity.

MILLET CROP-SORGHUM, PLOT-TRIALS, MEASUREMENT EXPERIMENT-DRYLAND.

208. Chetty, C.K. Ramanatha ; Reddy, M. Narayana. Optimum size, shape and orientation of experimental plots with dryland Sorghum , Indian. J. agric. Sci. Sept. 1987, 57(9),653-8.

For the experiments of dryland 'CSH6' Sorghum (Sorghum bicolor (Linn.) Moench) as a test crop on inceptisols, the size of the plot 35 m^2 and 45 m^2 with an approximate rectangularity of 3 plots was found adequate for the purpose. Generally, the longer side of the plot should be across the crop seed rows for minimizing experimental error, unless the seed rows sown along the fertility gradient. The suitable dimensions of the plot 12m across and 3.5 m along the seed rows.

PULSE-CROP PIGEONPEA,PLOT-TRIAL,EXPERIMENT-DRYLAND

209. Narayana reddy, M.; Chetty, C.K. Ramanatha. Experimental plot size and shape based on data from a uniformity trial with dryland pigeonpea. Indian J. Agric. Sci. Aug.1985,55(8), 538-43.

For sowing of pigeonpea as a role crop on rainfed drylands at its optimum inter-row spacing of 90 cm., the 23 m^2 size of the plot was found to be optimum. Variability in the size of plot was found due to factors of crop geometry.

RESEARCH-PROSPECTS -DRYFARMING

210. Jodha, N.S. Dryfarming research : Problems and prospects. Economic Times. Feb. 5, 1986,12 (314),12 (II).

In the past, the government was aware of the problems of drought prove areas. Public interventions in these areas have thus emphasized measures that perpetuate dependence of dry tracts on other areas. The first step in this direction would be the development of appropriate technologies to suit the natural resource base and environments of dry farming regions. Historical records show that share allocated to dry land farming was very small in proportion. Technology relevant to dry farming situations should have components that help in exploitation of favourable opportunities and and in maximizing the scope for adjustment during unfavourable conditions. The criteria of success should include improving grain yields alone, number of total options generated by the technology to adapt to fluctuations in environment , a variety of crop options mid season corrections, changes in input use intensity at critical stages alternative uses of

land involving agroforestry, silvipastoral etc. The new approach strongly emphasizes land and water management. In situ moisture conservation, proper drainage, runoff collection, and recycling of water for supplemental irrigation are tried. Crop varieties and hybrids have also developed having different genotypic and phenotypic characters.

RESISTANT -

RUST, WHEAT-VARIETY 'IWP72'- RAINFED

211. Rao, M.V.; Naqvi, S.M.A.; Luthra, J.K.;Pahuja, A.N. 'IWP72'- A new rust resistant wheat for rainfed areas. Indian Fmg. Dec. 1979, 29(9), 22-3.

At present in North-Western India we have two varieties which are generally grown under rainfed conditions, namely, 'C 306' and 'K 68' but these are susceptible to all the three rusts. Therefore, in order to over come these problems, the variety IWP 72 has been developed from a backcross involving an American variety 'E.6056' and 'Kalyansona' meets the above requirements as it possesses high degree of resistance to rusts and does not lodge. This variety gives very good response under medium fertility limited irrigation facilities. The highest yield recorded by IWP 72 was 44.3 q /ha while the top most yield of 'C 3d' was 39.6 q/ha.

SOIL-BLACK

DRAINAGE-POOR,CULTIVATION,CROP-CEREAL, RICE-RAINFED

212. Urkurkar, J.S.; Sastri, A.S.R.A.S. ; Patel, S.R. ; Chandrabanshi, B.R. Rainfall cistern system under rainfed cultivation of rice in poorly drained black soils of vertisol group in chhatisgarh region. Ann. Arid Zone. 1983,22(3),203-8.

In this study the econometrics of the rainfall has been analysed. The rainfall cistern system is a series of raised and Sunken bed system. In raised beds soyabeen and in sunken bed rice were grown. The rainfall from raised bed is collected as induced runoff in the sunken bed.

IRRIGATION-PONDS,CROPS-GENERAL,ECONOMIC ASPECT-DRYLAND

213. Narayan, H.C. ; Itnal, C.J.; Gopalkrishna, B.; Patil,V.S. Evaluation of Supplemental irrigation through farm pond on dryland. Indian J. Soil Conserv. 1987, 15(1), 1-5.

Study analyses the economics of utilisation of farm pond water in medium deep black soils in dryland areas based on crop response obtained at the Research station, Bijanpur. The cost of unit quantity of water stored has been estimated by amortization of the investment cost as well as the annual costs. The cost of irrigation per hectare was Rs. 7.84 for giving one protective irrigation and Rs.1694

for giving two protective irrigations. Though the crop response was about 36-37 % for two irrigations, bringing about an additional return ranging from Rs.1300 to Rs.1800 per hectare in Jowar and sofflower crops.

EROSION

PREVENTION, CROP-CEREAL, WHEAT, DRYLAND

214. Agrawal, J.P.; Sardar singh. Improved package of practices for dryland wheat. Indian Fmg. Nov. 1971,21 (8),19-20.

The yield of barani areas ranges from 5.0 to 8.0 q/ha package of practices are adopted, the yield level of the dryland can be increased Moisture should be conserved by checking of Runoff and erosion losses, deep ploughing before monsoon, 3-4 harrowings during monsoon as and when season permits, and by applying 10-15 costloads of bulky organic manuses that will increases the waterholding capacity and physical conditions of the soil. Sowing should be done when day temperature approaches round about 80-85°F. so that the moisture zone may not go deeper before seeding. Kalyan sona, K.65 and C.306 varieties were recommended for dryland farming. A dose of 40 kg N/ha along with 30 kg P_2O_5 per hectare should be applied at sowing. If spraying facilities are available then 2/3rd of N should be placed in furrows at 10-15 cm depth and remaining 1/3

dose be sprayed on the crop after 40 days of sowing. 100 kg seed per hectare at row spacing of 20 cm should be sown to proper space for the development of the plants. To check the soil moisture by weeds, application of 2,4-D at one Kg/ha with 600 litres of water should be sprayed between 30-35 days of sowing .Control of insect, pests should be done by using 5% BHC, seed treatment with Agrosan G.N. and others.

GENERAL, AGROMETRY, MICRO-NUTRIENT-BORONE-RAJASTHAN-WESTERN

215. Gajbhiye, K.S. ; Kolarkar, A.S. Study of water soluble boron in some rainfed soils of western Rajasthan. Ann. Arid Zone. 1979, 18(4),246-52.

Study showed that in 42 soil samples taken from rainfed areas of western Rajasthan, the water soluble boron varied from 0.43 to 2.58 ppm. It concerned significantly only with EC(Sat) (r = 0.65 T) and soil + clay (r=0.697) amongst the soil character istics studied and hence its fertility status may be assumed by the equation Y=0.0982+ 0.2442 1 + 0.0353 x (R = 0.823). In this equation y,x1, and x2 is boron, EC(Sat) and silt + clay respectively.

LOW-LAND,CROP-PRODUCTION,CROP-CEREAL RICE-efficiency, NITROGEN-RAINFED

216. Singh, B.K; Thakur, R.B.; Singh, R.P. Increasing nitrogen efficiency in lowland rainfed rice Indian J. Agron Sept. - Nov. 1982, 27(3), 297-9.

An experiment was conducted at the Rajendra Agricultural University Farm, Pusa during Kharif season of 1979. A uniform dose of 40 Kg P_2O_5/ha as single superphosphate and 20 kg K_2O/ha was applied .The grain yield increased significantly with increasing levels of nitrogen, the extent of yield increase at 40 and 80 kg N/ha . Application of 80 kg N resulted in 12.5 percent increase in grain yield over 40kg N/ha.

MEIDUM

CULTIVATION,SAFFLOWER, FERTILIZATION-DRYLAND

217.Rajat De; Turkhede, B.B.; Gangasaran.Safflower a good rabi crop for drylands Indian Fmg. May 1974, 24(2),26.

Investigations reveal that safflower can be safely recommended as a rabi crop for unirrigated areas of North India. It was mainly used as a source of dye and now the crop is exclusively used for oilseed purposes. A well drained soil of medium texture and fertility having 500 to 600 mm annual rainfall is preferred . In 1972-73, four varieties namely Nag-7 , No. 62-8, A-300, No.7-13-3 were grown during rabi season on conserned moisture. The crop was fertilized with 40 kg of N and 25 kg of

P_2O_5 /ha. The seed rate used was 25/ha. Safflower varieties Nag-7, and No. 7-13-3 gave yields upto 30 quintals per hectare in unirrigated land which gave a net profit of about Rs.2500 per hectare.

DROUGHT PRONE ,CROP PRODUCTION,RICE,CULTURAL PRACTICES RAINFED.

218. Nayak, B.C. ; Lenka, D.Studies on cultural practices for rainfed shallow drought prone medium land rice. Indian J. Agron. Mar-May 1988, 33(1), 1-6.

Study was conducted to findout the effect of different seeding / planting and weed control methods on the yield of rice. In dry conditions direct seeding gave higher yield than transplanting . Broad cast with or without beusan was as good as sowing behind plugh followed by interculture in the interspace or sowing with seed drill followed by interculture with weeder. High yilding rice varieties like shakti and Jajati could be grown by dry broadcast and beusan and produce 4.3 to 5.0 tonnes grain per hectare.

POOR,CROP PRODUCTION,CROP CEREAL,WHEAT-GROWTH, FERTILIZATION-UREA-SPRAY, EXPERIMENT-RAINFED.

219. Grewal, S.S.; Mittal, S.P. Effect of foliar spray of urea on rainfed wheat grown under poor soil fertility conditions in siwalik Foot- hills. Indian J. Agron. Dec-

Feb 1982, 27(4), 448-50.

An experiment was conducted during rabi at Sukho Majri (Haryana) wheat variety S-308 was sown in the first week of January in 1979. The treatment consisted of 4 sprayings of 6% concentration of urea (one spray at tillering, two spray one at tillering and the second 15 days after, three sprays, at 15 day interval from tillering stage and control no spray) Results showed that grain yield of late sown wheat increased from 20-35 % by one or two foliar sprays of 6% urea.

SOILS-SANDYLOAM

AGRONOMY, CROP PRODUCTION FERTILIZATION TRIALS

CROPPING PATTERN -RAINFED

220. Verma, R.S. ; Taneja,S.K. Relative compatibility of different crops sown mixed with Barley at different fertility levels under rainfed conditions. Indian J. Agron. Mar-May 1980,25(1) 92-6.

Field trials were conducted during two rabi seasons of 1972-73 and 1973-74 at the R.B.S. College Research Farm Bichpuri (Agra) on Sandy loam soil of medium fertility, revealed that sowing of barley in mixed as well as in the winter pure crop gave maximum net return under such conditions. Sowing of barley alone proved superior with respect to yield and monetary return to other crop mixture

of barley and mustard. Among the companion crops mustard gave highest profit followed by linseed. The additional supply N, P. and K at 20 kg each to the companion crop did not show any significant role except in case of mustard alone. The risk of complete crop failure due climatic reasons can be reduced if barley is sown mixed with companion crop.

CROP CEREAL BARLEY-RAINFED

221. Bajpai, R.P. ; Singh R.A. A note on manuring of black gram and its residual effect on barley under rainfed conditions. Ann. Arid Zone. 1982 21(4), 249-51.

This experiment was conducted on Sandy clay loam soils during 1976-77 and 1977-78 under dryland conditions of varanasi. Study was to investigate the effect of fertilizer applied in blackgram and their residual effect on succeeding crop of barley. The application of 30 and 60 kg P_2O_5 per hectare gave grain yields of 8.03 and 8.529/ per hectare and it showed the significant increase of 12.4 and 17.8 percent over that of control. The response equation obtained was $7.23 + 0.031\ x - 0.0017\ x^2$ and the application of 35.3 kg P_2O_5 per hectare was found profitable. The grain yield could be increased by using Rhizobium alone and in combination with phosphobacterian culture inspite of using phosphobacterian alone.

CULTIVATION,SOWING ROWS -FERTILIZER-

NITROGEN-DOSAGES-DRYLAND

222. Balyan, J.S. : Singh, S.P. Effect of Plant rectangularity and nitrogen on Sorghum under dryland conditions. Indian J. Agron. Sept-Nov. 1985, 30(3),391- 2.

A field experiment was conducted at the Indian Agricultural Research Institute, New Delhi in Kharif 1982 on Sandy loam soil of 7.8 pH containing 92,17.4 and 185 kg/ha of available N,P and K, respectively to find out. the optimum plant density along with the rectangularity and nitrogen fertilization. Treatment comprised two row spacings (30 and 45 cms) and three rectangularilzes (1,2 and 3). In case of yield, row spacing and rectangularity did not show any perceptible influence . Production markedly increased due to 40 kg N/ha over no nitrogen but, there was no significant response to nitrogen beyond 40 kg /ha.

DRYFARMING

MANAGEMENT, WATER MOVEMENT ,DRYFARMING

223. Dayal, Rajbans ; Akshayaber Singh ; Sarap, N.H. preliminary study movement of available water in Sandy loam soils under dry farming conditions .Ann. Arid Zone. 1973, 12(3 &4), 172-8.

Study indicated the availability of moisture under dry land condition in relation to sowing / planting time of crop.Experiment revealed that crop sown / planted in the early stages of rainfall provide better utilization of moisture and availability of it during the crop growth.

Crops sown lated showed the deficit of moisture at later stage of crop and resulted in low yield.

-SILTY-CLAY, CROP-TRITICALE,FERTILIZATION NITROGEN REQUIREMENT-RAINFED

224. Masood Ali; Rajput, P.R. A note on the studies on nitrogen requirement to triticale under rainfed conditions Ann. Arid Zone 1978,17(2),229-32.

Study investigated the effect of doses and methods of N application on the yield of triticale grown on the silty clay loam soil under rainfed conditions, under shallow water conditions the application of 60 kg N/ha significantly, increased the number of spikes number of grains per spike and grain and straw yield crop gave marginal response when N used beyond 60 kg /ha.

-SLOPES, CROPS-MINOR MILLETS-RAINFED

225. Tyagi, D.V.S. ; Rawat, R.S. Two new ragi varieties for rainfed areas. Indian Fmg. Mar. 1989,38(12),3.

The All -India Co-ordinated millets improvement scheme has investigated two new ragi varieties named plant Manduaz' and 'PES 110' in rainfed areas and high hill slopes, where other crops fail to grow this crop thrives well and produce of the crop-grain and fodder are nutritionally rich. The productivity has increased from 700 kg per hectare to 1,150 kg per hectare. Plant Manduaz , has its pigmented small compact top curned earhed and the the pigmented nodes. PES 110' is a non-pigmented long duration variety (115-120 days) with moderate to high tillering abilities.

SOILS UPLAND

COASTAL ALLUVIUM, CROP-PRODUCTION, CROP CEREAL-RICE VARIETIES EVALUATION-RAINFED

226. Jha, K.P. ; Manna, G.B. on farm evaluation of promising early rice (Oryza sativa) varieties under rainfed uplands of coastal alluvium and red lateritic soils. Indian J. agric. Sci. Aug. 1989, 49 (8), 490-4.

The experiment conducted in the rainy seasons of 1984-87, promising early varieties of rice were evaluated on the upland red laterictic soils. The variety 'Ananda ' gave mean yield of 4.75 tonnes /ha and a net return of Rs. 4755/ha compared with a mean yield of 1.42 tonnes per hactare and a net monetary return of Rs.487/ha by local control. The medium size variety 'Banaprabha' grown in the red lateritic soils, gave yield of 3.13 tonnes / ha

rainfed lateritic soils gave less yield than Banaprabha'.

CROPS CEREAL RICE,VARIETIES PROMISING INDIA-EASTERN.

227. Nigam, R.K.; Chandra, D. ; Manna, G.B. Promising rice varieties for rainfed uplands of eastern India. Indian Fmg. April 1988, 38(1), 20-21.

Experiments were conducted to evolve agronomic practices for the promising rice varieties for the rainfed uplands of eastern India. 'Sattari' (CRM-13-3241) variety was tested on the soil lacking proper agronomic management. Efforts were made to develop suitable management practices for the rice varieties at CRRI. The field was prepared before the or set of monsoon to have good little to achieve uniform growth. Bold seeds were selected by screening in brine solution of 165g common salt per litre of water. Seeds were treated with Thiram at 2.5g per kg seed. Healthy seeds were sown in the second week of June at the rate of 75-80 kg per hectare at a distanceof 20 cm. per line. Hand weeding and ranking was attended twice. A fertilizer dose of NPK, 60kg 30 kg, 30kg/ha was used per hectare. crop requires protection against Gandhi bug by using BHC. All the cultures performed well and gave higher yield in 1981 and 1983 contrary to that of 1982 and 1984 due to the severe drought stress.

VAR(Kalinga) PROMISING-RAINFED

228. Srinivasulu, K ; Balakrishna rao, M.J.; Krishnamurty, A. 'Kalinga -III' A promising early -duration rice variety for rainfed uplands . Indian Fmg. May 1988,38(2),17-9.

A new variety of rice called 'Kalinga III' has been evalued for the formers growing rice on upland under rainfed conditions. It is early duration, tolerance to moisture stress variety. Several promising early duration lines derived from the cross 'AC540 x Ratna ' were screened in upland rainfed conditions CR 237 -1'was tested in experimental fields, based on its performance, the state seed sub-committee released this line line as 'Kalinga-III' in 1984. It is suitable for direct seeding in rainfed uplands during kharif season. The seed rate showld be 100 to 125 kg per hectare. Application of 20 kg N and 20 kg P_2O_5 per hectare after first weeding and another dose of 10to 15 kg N per hectare after second weeding is recommended. This is also suitable for rabi season, during this season it matures in 105-110 days. Fertilizer application of 40 to 60 kg N and 30 kg P_2O_5 per hectare is recommended.

CROPS-PULSES,GREEN GRAM/BLACK GRAM,INTERCROPPING - SOWING TIME- BIHAR.

229. Rafey, A. ; Pasupalak, S.N. ; Verma, U.K. Optimum time of sowing green gram and blackgram as intercrops of pigeonpea

in the rainfed uplands of Bihar. Indian J.agric. Sci.Feb.1986, 56(2),92-6.

A 2-year field study held at Ranchi, Bihar, indicated that the maximum net return of ₹.3,474/ha was obtained from intercropping of pigeonpea + blackgram Cajanus Cajan (Linn.) Millsp + Vigna mungo (Linn.) Helpper). The crops were sown on 1 July, followed by a main crop of blackgram, sown on 1 July.

PLANT-DENSITY,FERTILIZATION-NITROGEN effect of-SORGHUM-UTTAR PRADESH,BUNDELKHAND.REGION.

230. Mehrotra, O.N. ; Mahesh Pal ; Singh, R.P. Note on effect of nitrogen and plant density on rainfed Sorghum in Mar-soil of Bundelkhand region of uttar Pradesh. Indian J.Agric Res.Jan Mar 1979, 13(1), 59-60.

A field trial was conducted at Research Form, Gursarai (Jhansi) during Kharif season of 1972 and 1973 on typical Mar Soil of the tract. The factors of Study included all combinations of 4 levels of nitrogen (0,40,80 and 120 kg N/ha) and 3 plant densities viz, 2,22,000 plants /ha, 1,48,000 plants /ha and 1,11,000 plants per hectare. 60 kg P_2O_5 and 60 kg K_2O/ha was also used as basal. The main effect of nitrogen and plant density showed significant effect on grain yield but the interaction of nitrogen X plant density failed to exert the effect. The results further indicated that the application of 40,80 and 120 kg N/ha increased the pooled grain yield by 63,79, and 93 percent. respectively, over control.

SOWING

DENSITIES YIELD -Comparative Study-SORGHUM-DRYLAND

231. Balasubramanian, V. ; Gangadhar rao, D. Yield components of dryland Sorghum at different plant densities in dryseason Indian J. agric. Sci. Aug. 1987, 57 (8), 550-3.

A field study conducted for two years indicated yield component expressions in dryland conditions, variation in plant density (7.5-20 plants /m^2) caused grain yield compensation through grains / penicle in 'CSH6' and 'Local Sorghum'. The rate of decrease in grains / penicle in a season. However, both grains / penicle and 1000-grain weight contributed to variation in the grain yield between seasons. Therefore, for stability in grain production, variation in grains / penicle and average grain weight between seasons should be minimized while crop improvement is attempted for drylands.

DIRECT,FERTILIZATION-NITROGEN,CROP-CEREAL RICE-DRYLAND

232. Singh R.A. ; Sharma , H.C. ; Singh, U.N. ; Mahatim Singh, Response of direct seeded rice to nitrogen under dryland conditions. Indian J. Agron. June -Aug - 1979, 24(2),161-5

Field experiments were conducted with three varieties of rice, viz. Saket 3, Ratna and Jaya each at four levels of nitrogen (0,40,80 and 120 kg N/ha) in a randomized block design. The results showed a consistent increase in the grain production with the increase in level of nitrogen. Among the varieties, Jaya gane highest yield followed by

Ratna and Saket 3. The average grain yields in terms of Kilogram of grain per hectare due to each kilogram of nitrogen applied at 40,80 and 120 kg N/ha were 55.2 ,32.2 and 22.9 in case of Saket 3,58.1, 38.7 and 28.2 in case of Ratna and 62,8, 42.9 and 37.7 in case of Jaya, respectively.

METHODS/FERTILIZATION -SARSON-DRYLAND

233. Bains, S.S.; Singh, R.P. Nothing succeeds like sarson on dry lands. Indian Fmg. Aug. 1971, 21(5), 5-6.

Among the principal dryland crops, sarson (Brassica campestris Var. Brown Sarson) is very much adaptable. Brown sarson Haryana No.1 has proved by far the best variety to be grown on conserved soil moisture It yields 20 to 22 quintals of grain per hectare. It requires only 20 kg nitrogen per hectare for achieving a yield potential of 21.6 quintals per hectare 5 kg seed/ha should be drilled through pora in rows 30 cm apart in the last week of September or first week of septem-ber, in good tilled soil. A mixture of 20 kg each of nitrogen phosphorus and potash per hectare should broadcast before the last ploughing. Thining and weeding should be done. For protection against insect pests Rogor which carries 30 per cent dimethoate as active ingradient, has proved very officaceous in controlling aphids.

-PERIODS,FERTILIZATION-PLACEMENT,BARLEY-DRYLAND

234. Singh, K.N.; Misra, B.N. Advancing time of fertilizer placement to dryland barley. Indian J.Agron. Dec- Feb. 1980, 25(4), 741-2.

A experiment with two dates of sowing (Oct.30 and Nov.25) five fertilizer rates (No, N20, N20 P20,N40 P20, N 20 P20 K20) and two times of fertilizer placement (Sept.30 and Oct.30 was conducted during the year 1978-79. Advanced placement of fertilizer to dryland barley gave significantly higher grain and straw production over the placement done at sowing time, the increase in grain and straw yield were of the order of 11,6 and 17.0 per cent, respectively.

GREENGRAM (Mung) - RAINFED

235. Saharia, P. Response of greengram (mung) to sowing dates under rainfed conditions. Indian J.Agron.Sept. Nov.1985,30(3). 345-8.

An experiment was carried out with six varieties of green gram tested under four sowing dates during Kharif season of 1981, 1982 and 1983 at the Regional Agricultural Research Station , Shillongam Nagaon (Assam). In all the years, the first half of August half of August was the optimum period for sowing of green gram. The highest grain yield was obtained by ML131, K851, out of all the varieties.

PRACTICES,FERTILIZATION -FURROWS-RICE, VARIETY (Annanda)

236. Balkrishna rao, M.J. 'Annada' A new high yielding rice for rainfed uplands . Indian Fmg. May 1989, 39(2),3-4.

Research and trials held at several all India and regional centres have investigated a new variety of rice

called 'Annada' for rainfed areas. It is semi-dwarf and matures in 100-105 days with an average yield of 3.7 tonnes per hectare. This variety 'MW 10' is the cross of 'Mt 4.15 and 'Yaikyoku Nantoku'was released as 'Annada'. Grains of this variety are short, bold with 1000-grain weight of 22-2g Sowing should be done at 20 to 25 cm distance between rows, at a seed rate of 40 kg per hectare either by drilling or behind the plough. Phosphorus and potash at the rate of 15kg per hectare may be applied at final land preparation with out application of 30 kg N per hectare after first weeding. Nitrogen is to be applied in two splits, half as basal dose and the rest at primordial initial stage.

ROW-SPACING, FERTILIZATION-PHOSPHATE -LEVELS-performance of PEA

237. Giri, A.N. ; Bhalerao,S.S. A note on response of rainfed pea varieties to row spacings and phosphate levels. Indian J. Agron. Sept-Nov. 1984.29(3),386-7.

An experiment was conducted at Agricultural Research Station, Badnapur of Marathawada on medium black cotton soil. six combinations of three varieties (EC 33866, BR-12,and L116) and two row spacings (22.5 and 30.0 cm) were placed in main plots and four phosphate levels (0,30,60 and 90 kg P_2O_5/ha). The highest grain yield was obtained from pea var L 116 followed by BR 12. Pooled analysis showed that the row spacings, phosphate levels and their interactions did not show any significant effect of the grain yield of pea.

FERTILIZATION PHOSPHORUS,CROP-PIGEONPEA, VARIETIES -Response of -RAINFED.

238. Chauhan,R.S. ; Singh, K.B. Response of Pigeon pea varieties to levels of phosphorus and row spacing under rainfed conditions. Indian J. Agron. Mar-May 1980,26(1),49-52.

The experiment consisted of 3 varieties of pigeonpea (Pusa Ageti, Sharda and T-21),3 row spacings (40,60 and 80 cm) and 4 levels of phosphorus (0,40 ,80 and 120 kg P_2O_5/ha). Application of phosphorus at 80 kg/ha proved beneficial to obtain the maximum grain yield being 69.5% higher than control. The row spacing of 60 cm gave significantly higher yield over 40 and 80 cm. row spacings. 'Pusa Ageti. produced the maximum grain of 11.24 q/ha that is significantly higher over sharda. Type-21 has also been reported as high yielding variety.

N & P ,YIELD -effect on -CLUSTERBEAN

239. Sharma ,V.D.; Verma, B.S. Effect of nitrogen , Phosphorus and row spacing on yields, yield attributes and oil content of safflower under rainfed condition. Indian J.Agron.Mar-May 1982, 27(1), 28-33.

A field experiment was conducted during two consecutive winter seasons of 1974-75 and 1975-76 at R.B.S. College Research Farm, Bichpuri (Agra). Experiment comprising 4 levels of N(0,30,60, and 90kg/ha), 3 levels of P_2O_5 (0,40 and 80 kg P_2O_5/ha) and 3 row spacings (30,45 and 60 cm) as variables on rainfed safflower. The optimum levels of N and P_2O_5 for good production were 59.8 and 33.8 kg /ha respectively.

A row spacing of 60 cm was proved to be superior over other row spacings. Phosphorus fertilization improved the oil content significantly.

SPACINGS-ROWS -Study of -GROUNDNUT, VARIETY (GAU G1)- RAINFED

240. Patel J.S.; Kistaria, M.N. ; Paida, V.P. ; Parmar , M.T. ; Patel, J.C. Response of rainfed groundnut (Archis hypogaeaL.) to varying Spacings. Indian J. Agron. Dec-Feb. 1985,30(4),468-9.

A field experiment was conducted at the main Dry Farming Research Station, Targhadia (Rajkot) on medium black clay soil during Kharif seasons of 1980 to 1982, to study the effect of inter-row spacings (30,45,60 and 75 cm) on yield of bunch groundnut (GAU G1) under rainfed conditions. Yields obtained were higher under row spacings of 30 and 45 cm. Which could be assigned to more pods and weight of pods / plant.

CASTOR, VARIETIES (Aruna /GCH-3)

241. Turkhede, B.B. ; Gangasaran, ; Rajat De. Response of castor varieties to dates of seeding under dryland conditions of North west India. Indian J. agric. Res. Oct. Dec. 1982, 16(4), 209-14.

It studied the performance of three castor varieties (Aruna, GCH-3 and local) under four dates of seeding at

monthly intervals starting from end of July. The variety Aruna gave highestyield whereas local was less yielding. The variety GCH-3 was at par with Aruna. Dates of sowing significantly affects the seed yield of castor. Duration of end July to end August was found optimum for getting good yields.

SOWING-TIME CLIMATE-effect of -DRYLAND

242. Ramkrishna, Y.S.; Singh, R.P. Influence of climate on crop production in drylands, Proceedings of Indian Nat. Sci. Acad. 1978 , 44 (6), 431-6.

In this study the importance of climate in the yield of crops grown dryland is discussed. The analysis of data for quite some time at Jodhpur showed that the suitable crops and their cultivars, cropping pattern and sowing time of some of the more important Kharif season crops. moong (Vigna radiata), Moth (Phoseolus aconitifolius), Guar (Cyamopsis tetragonoloba), Sunflower, Groundnut, till (Seasome), Bajara (Pennisetum americanum) and cowpeas are suggested.

-DELAYED,GROUNDNUT-VARIETIES (TMV 10,2 M 13)-EXPERIMENTS.

243. Reddy, T.Y. ;Reddy, P.M. ; Reddy, T.B. ; Reddy , S.Rami ; Reddy, G.H. Sankara, Studies on Suitable varieties of groundnut

from normal and delayed sowing under rainfed conditions. Indian J. Agron. Mar-May 1984,29(1),55-60.

Field experiements were conducted on Sandy loam soils for three years to study the effect of time of sowing and three varieties of groundnut under reinfed conditions. In all the three types of varieties, pod yield decreased gradually as the sowing time delayed. This reduction occured due to decreasing number of pods/plant. Shelling percentage and 100 Kernel weight TMV10 M 13 and TMV 2 varieties gave the highest pod yields in 1978,79, and 80, respectively. The virginia bunch and virginia runner types were better than Spanish burch types for rainfed cultivation.

NITROGEN-DOSAGES YIELD -effect on-WHEAT

244. Sharma, R.P.; Ray, S.B. ; Parashar, K.S. Studies on the effect of fertilizer doses and water volumes applied at sowing time on the yield of wheat grown under dryland conditions. Indian J. Agron. Sept.Nov. 1981, 26(3), 213-9.

Study described the effect of fertilizer doses and water volumes applied at sowing time on the grain yield of wheat variety 'Kalyan Sona' under dryland conditions. The soil on which the experiment held, was of low fertility having a pH of 7.7. The experiment was conducted with three levels

each of fertilizer (No fertilizer 40 kg N+ 20 kg P_2O_5 80 kg N+40 kg P_2O_5/ha) and water volumes (no water, 10,000 and 20,00 /ha. Results showed that the application of 40 kg N + 20 kg P_2O_5/ha increased the production and was marginally superior over the higher dose. Along with this, water application at the time of sowing at 20,000/ha gave significantly higher yield than no water and less amount of water.

FERTILIZERS -effect of MUSTARD VARIETY (T59)-EXPERIMENTS

245. Prakash Vir ; Verma, B.S. Effect of nitrogen , phosphorus and row spacing on yield, yield attributes and oil content of rainfed mustard. Indian J.Agron. Mar-May 1980,26(1) 37-41.

The experiment was conducted at the R.B.S. college Research Farm, Bichpuri (Agra) during winter seasons of 1974-75 and 1975-76. Experiment comprising 4 levels of N(030, 60 and 90 kg N/ha), 3 levels of P (0,30 and 60 P_2O_5/ha) and 3 row spacings (30,45 and 60 cm) as variables on rainfed mustard (variety-T59). The crop gave significant yield at 60 kg N and 30 kg P_2O_5/ha, but the optimum level of nitrogen and phosphorus were 50.6 kg N and 36.7 kg P_2O_5/ha. A row spacing of 45 cm was proved to be superior than others. These treatments did not affect the quality in terms of percent oil content in seed.

TECHNOLOGY-RICE,VARIETIES (Rasi/Narendra) DRYLAND

246. Singh, T.N. ; Gulab Singh ; Singh, H.P. Technology for dryland rice in eastern Uttar Pradesh, Indian Fmg. May 1986,36(2), 30-31.

The technology includes efficient use of rainfed water. The success or failure of dryland rice is totally dependent upon the rainfall received during late June to early October in eastern U.P. The choice of variety entirely depends upon the spread of rains and the duration of rainy season which generally spans from 80 to 90 days. Trails were conducted at various fertility levels with dwarf varieties such as : 'Rabi', 'Narendra-', cauvery 'IFT 826' etc. and medium tall types such as N22', 'Browngora' etc. The sowing of dryland rice should be done only in rows with in between spacing of 20 cm. using 100 kg healthy seeds per hectare. For maximum use of rainfall water fields should be strongly bunded. Most of the varieties responded significantly upto 60 kg N per hectare and declined only thereafter. Application of 60 to 80 kg. nitrogen per hectare gave grain yield up to 37-45 q/ha. The application of P_2O_5 and K_2O each at 30 kg per hectare as basal dressing also proved beneficial. Half dose of N. at the time of sowing and remaining half should be profitably applied as top dressing after removing the weeds at tillering stage. Though the hand weeding proved most effective yet use of chemical herbicides particularly propand (Stam F-34) and 2,4D proved quite successful in eradicating weeds.

YIELD -effect on-CLUSTERBEAN,VARIETIES(FS 277)-DRYLAND

247. Masood Ali.Effect of plant types and row spacing on cluster bean production under dryland conditions. India J. Agron. June -Aug. 1982,27(2),144-8.

The field experiments were carried out during Kharif seasons of 1977 and 1978 under dryland conditions at Indian Grassland and Fodder Research Institute, Jhansi. Results revealed that on alfisols Durgapur Safed and B19-1-55 were high yielding varieties of clusterbean out yielding FS-277. The optimum row spacing for Durgapur safed was found to be 60cm. where as for B-19-1-55 was 45 cm. The seed yield was depend upon number of pods per plant.

WEED CONTROL-Study of

MAIZE,REGIONS-SHIWALIK -FOOT HILLS-RAINED

248. Mittal, S.P.; Pratap Singh ; Dayal, S.K.N. ; Sud, A.D.; Madan Lal Weed Control measures in rainfed maize (Zeamays) in Shiwalik foot-hill region. Indian J.agric. Sci. April 1989, 59(4),251-4.

Study indicated use and effect of atrazine (2-chloro-4-ethylamino-6- isopropylamino-s-traizine) immediately after sowing of maize and different schedules of manual weeding were studied on biomass production, nutrient loss through weeds maize yield, net returns, run off and soil loss. It was found effective to use atrazine @ 1 kg ai/ha +2 weedings 15 and 30 days after sowing, for reducing the N loss through weeds to the minimum. This treatment gave

(2528 kg/ha) and straw (8541 kg/ha) yield of maize, net return of Rs.3359 per ha and soil loss (12.51 tonnes /ha) in comparision to other treatments.

MILLETS-SORGHUM-BUNDELKHAND -DRYLAND

249. Masood Ali. Studies on weed management in Sorghum on drylands of Bundelkhand. Indian J. Agron. June Aug 1979,24(2), 150-55.

Field experiment was conducted on central Research Farm, Indian Grassland and Fodder Research Institute, Jhansi during Kharif seasons of 1976 and 1977. Study revealed that pre-emergence application of 1.0 kg atrazine (2-chloro-4-ethylamino-6-isopropylamino-1,3,5-triazine) per hectare was very effective in suppressing weed flora, reducing crop weed competition (weed Index-8.8) and enhancing Sorghum grain production and highly remunerative (Rs. 947.70 additional profit/ha over unweeded check). The next best weedicide was 0.75 kg/ha atrazine. Use of atrazine at 0.50 kg /ha, yielding significantly lower (10.06q) than that of others. The combined application of 2,4-D (post -emergence) along with atrazine (Pre-emergence) could bring only marginal increase in production over use of atrazine alone.

-TILLERING-RAINFED.

250. Kaushik, S.K. ; Gautam,R.C. weed control studies in pearlmillet under rainfed condition. Indian J.Agron. Mar-May 1984,29(1), 31-6.

This study determine the most effective method of weed control in hybrid pearlmillet (pennisetum americanum L.) under rainfed conditions revealed that at both higher (0.5kg a.i./ha as well as lower (0.25 kg a.i./ha doses with and without one haeings and hand weeding twice at three and six weeks after sowing were the most effective treatments for weed eradication and enhancing the grain production of pearlmillet significantly over unweeded conditions.

WEEDICIDES-CHEMICAL-RAINFED

251. Yadav,D.S. ; Singh, K.B. ; Sharma, V.D. ; Prakash vir ; Solanki, N.S. ; Ved Ram. Studies on the Chemical control of weeds in pearlmillet under rainfed conditions. Indian J.Agri. Res. April -June 1978, 12(2) 73-8.

This study was conducted at the All India coordinated Research sub-centre R.B.S. College Bichpuri, (Agra) U.P. to find out the most effective herbicide and its rate of application to control the weeds in rainfed pearlmillet. Control of weeds either mechanically or chemically resulted an increase in the yield of pearlmillet ranging from 3 to 103 percent over control.Atrazine at the rate of 1 kg/ha (Pre-emergence) resulted in the drastic reduction in the dry weight of weeds at harvest and subsequently increased the yield by 103% and also proved most remunerative with the additional net return of Rs.120.5 /ha over control.

PART THREE

APPENDICES & INDEX

LIST OF JOURNALS DOCUMENTED

NAME OF JOURNAL	ABBREVIATION USED
Agricultural scientific Digest	Agric. Sci. Dig.
Agricultural Situation in India	Agrl. Situ in India
Andhra Agricultural Journal	Andhra Agric.J.
Annals of agricultural Research	Ann. agric. Res.
Annals of Arid Zone	Ann. Arid Zone.
Geographer	Geographer
Geographical Review of India	Geogra. Rev. India
Indian agriculturist	Indian Agric.
Indian Co-operative Review	Indian Coop Rev.
Indian Farming	Indian Fmg.
Indian Journal of agricultural Economics.	Indian J. of Agric. Eco.
Indian Journal of Agricultural Research	Indian J. Agric. Res.
Indian Journal of Agricultural Science.	Indian J. Agric. Sci.
Indian Journal of Agronomy	Indian J. Agron.
Indian Journal of Plant Physiology	Indian J. Pl. Physiol.
Indian Journal of plant science	Indian J.Pt. Sci.
Indian Journal of soil conservation.	Indian J. Soil. Conserv.

Indian Journal of Tropical agriculture	Indian J. trop. Agric.
Journal of Maharastra Agricultural University	J. Maharashtra agric. University
Journal of oil -seeds Research	J.Oil. Seeds Res.
Journal of Research Assam Agricultural University	J.Res. Assam Agric. Univ.
Journal of Scientific Research Bhopal.	J.Scient. Res. Bhopal
Kurukshetra	Kurukshetra
Leucaena News Letter	Leucaena News Letter
Madras agricultural Journal	Madras agric. J.
Pesticides	Pesticides
Proceedings of Indian National Scientific Academy	Proceedings of Indian Nat. Sci.Acad.
Pulse Crops News letter	Pulse crops News letter.

NEWS PAPERS

Economic times	Economic times
Financial Express	Financial Express
Times of India	Times of India

LIST OF ABBREVIATIONS USED

@	At the rate of
BH.C.	Benzene Hexachloride (Gamaxine)
Ca	Calcium
Cal.	Calorie (Energy)
Cm	Centimeters (Measurement)
CO	Coimbatore (varieties of sugarcane)
CRRI	Central Rice Research Institute , Cuttack
CSH	Used for Sorghum Hybrid
Cv.	Cultivars
D.A.P.	Diammonium phosphate
DL	Delhi (used with varieties)
FYM	Farm Yard Manure
ha	Hectaire
HB	Hybrid Bajara
HD	Hybrid Delhi
I.A.R.I.	Indian Agricultural Research Institute, New Delhi.
I.C.R.I.S.A.T.	International Crop Research Institute for Semi Arid Tropics.
K & K20	Potash/ Potassium (Fertilizers)
KNO3	Potassium Nitrate
L	Linn. (Used with scientific names of the crops)
Mo	Molybdenum (Trace element)
MVP	Marginal value product
N	Nitrogen
PACS	Primary Agricultural credit Societies
P&P_2O_5	Phosphorus (Fertilizers)

PPM	Parts per million
q	Quintals (weight)
R1, R2, R3	Row spacings
S	Sulphur
S1,S2,S3	Plant spacings
Stam F34	Weedicide
S.W.	South-west
T	Type (use with varieties of crops)
TIBA	Tri-iodo Benzoic acid
TOK E-25	Weedicide
2,4-D	2,4-dichlophenoxyacetic acid (Weedicide)
USG	Urea super granules
VL	Vivekanand Laboratory (used with varieties)
WHC	Water Holding capacity
WUE	Water use efficiency
Zn	Zinc
$Zn\ SO_4$	Zinc Sulphate

Apart from these, there many abbreviation which have been used with the variety of crops.

GLOSSARY

Agraeconomics - The term used for covering the economic aspects of agriculture.

Agrometry : - The term used for agriculture measurements, such as plot size, amount of water, and planting /sowing distance etc.

Agronomy : The science of crop-production and soil management ,The name is derived from the Greek words agros (field) and nomos (to manage).

Annual : A plant that completes its life cycle from seed in one year.

Arid climate : A dry climate with an annual precipitation of usually less than 10 inches and not suitable for crop- production without irrigation.

Arid Zones : Areas of arid climate and soil where crop production is only possible by providing water to the crops either by irrigation or rains.

Band Treatment : To apply an herbicide in bands usually 12 to 15 inches wide directly over crop rows.

Biennial : of two years duration. A plant germinating one season and producing seed the next.

Black soil : Soils having properties like highly argillaceous, very fine grained dark and contain a high proportion of calcium and magnesium carbonates. They are very tenacious of moisture and exceedingly. sticky, when wet.

Broad cast : To sow or scatter seeds and fertilizer on the surface of the land by hand or by machinery.

Cereals : Plants cultivated as a crop in the rabi (winter) season for its edible seed or grains. for example, Barley, Rice, wheat etc.

Climate : The total long time characterstic weather of any region.

Combine : A machine for harvesting and Threshing in one operation.

Contour Furrows :- Furrows plowed at right angles to the slope at the same level or grade, to intercept and retain runoff water.

Drainage : Romoval of water accumulated in the soil either from rains or through seepage from canals or irrigation channels and reservoirs, through any system of passing away water.

Drought : Lack of falling down of rains becomes the drought conditions of any region drought occurs over an area of where annual rainfall is less than 75 percent of the normal.

Dryland farming : Farming of even those area which are located in moist areas but where agriculture is largely rainfed may be regarded as Dryland. farming .Dryland farming is that of not only rainfed agriculture but arid and semi arid environment.

Fertility (Soil) :- The ability of soil to provide the proper compounds in the proper amounts and in the proper balance for the growth of specified plants under the suitable environment

Fertilization (Soil) : - The application to the soil of elements or compounds that aid in the nutrition of plants.

Ferto-fungicides : - The term used for combination of fertilizers and fungicides and are used in the soil/ crops for both purposes.

Fodder : - Maize, Sorghum, or other coarse grasses harvested whole and cured in an errect position. Pulled fodder is the leaves of corn or sorghum stripped by hand from the standing stalk and then cured. Topped fodder is the top of the maize stalk above the ear, cut off and cured.

Forage : Vegetable matter, fresh or preserved gathered and fed to animals.

FYM : Farm yard manure is the mixture of cattle dung, the beeding used in the stable and of any ramnants of straw and plant stalk fed to cattle. It is the most valuable organic matter applied to a soil.

Green manure : Any crop or plant grown and ploughed under to improve the soil, especially by addition of organic matter.

Harrow : An implement used chiefly for seedbed preparation which stirs the soil, breaks clads, smooths the field, and kills weeds. Spike tooth, spring tooth, and disk harrows are used.

Humid Climate : A climate with sufficient precipitation usually to support a forest vegetation .The precipitation in humid regions usually exceeds 30 to 40 inches.

Humus : The well decomposed, more or less stable part of organic matter of the soil.

Hybrid : The off spring of two parents unlike in one or more heritable characters.

Insecticides : A chemical used to kill insects.

Intercropping : A type of cropping system growing of two or more crops simultaneously on sufficient row spacing. Meaning growing of crop among the row of other crops. e.g. Sorghum + pigeonpea, Sorghum+ Soyabean, Sorghum+ Groundnut .

Legume : Any plant of the family Legumino-sea. The pod of a leguminous plant.

Lime : Calcium oxide or quick lime (Cao) but often refers also to calcium carbonate ($CaCO_3$) and to calcium hydroxide or hydrates or slaked lime ($Ca(OH)_2$).

Loam : A soil composed of a mixture of two or more of the separates clay, silt, sand and gravel.

Mixed Cropping : Method of growing the crops more than one in a mixed form without maintaining the spacings of rows and plants. eg. wheat and barley Barley and gram etc.

Mulching : The process of covering the soil and crops either by natural or artificial means to reduce evaporation, to increase infiltration, to keep down weeds, to improve soil structure and eventually to increase crop yields.

Nitrogen fixation: The conversion of atmospheric (free) nitrogen to nitrogen compounds, chemically or by soil organism living in the roots of legumes.

Nutrients (Plant) : A chemical element taken into a plant that is essential to its growth, development, or reproduction.

Ploughing : is the process of turning up of the soil in the form of furrows and ridges with the help of plough or harrows etc.

Past emergence : Stage after emerge.

Pre- emergence. Stage before emerge

Productivity ofsoil : The capability of soil for producing a specified plant or sequence of plants under a specified system of management.

Rainfed Agriculture : The farming on drylands which depends solely on the rains.

Sand : Small rock or mineral fragments having diameters ranging from 1 to 0.05 mm.

Seedling : The juvenile state of a plant grown from Seed. A plant derived from seed (in plant breeding).

Silt : Small mineral soil particles of a diameter of 0.05 to 0.002 mm.

Soil : The natural medium for growth of plants on the surface of earth, composed of organic and mineral materials.

Sowing : To place seeds in a position of growing.

Straw : The dried remnants of fine - stemmed plants from which the seed has been removed.

Strip cropping : Growing crops in long narrow strips across a slope approximately on a line of contour with dense growing crops alternating with inter tilled crops.

Sub soil : That part of soil below plough depth or below a horizon.

Surface Soil : The upper 5 to 8 inches of the soil or in arable soils, the depth commonly strirred by plough.

Tiller : An erect shoot arising from the crown of a grass.

Tieth : The physical condition of soil with respect to its fitness for the planting or growth of a crop.

Transpiration: The evaporation of moisture through the leaves.

Variety : A group of individuals within a species that differ from the res+ of the species.

Weed : A plant that in its location is more harmful than beneficial.

Weedicides : Chemicals used to eradicate weeds.

COMBINED AUTHOR,TITLE AND SUBJECT INDEX

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

PEST CONTROL

MANAGEMENT

INSECTICIDES

INSECTS

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry No.

Entry no.